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Flood risk management strategies and resilience: The capacity of key stakeholders to respond to the unexpected course of flood disasters in the city of Accra, Ghana

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Flood risk management strategies and resilience:
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Raphael Ane Atanga

Dedication

I dedicate this thesis to my late parents, Mr. Atanga Nasara and Mrs. Awuloore Pwayine, who endorsed my education from childhood. They had always prayed for God's blessings to pursue my dream to a successful end. Although they did not live long enough to see me through the academic ladder, their prayer for blessings and success is a living memory. I would forever remember them and may their souls rest in perfect peace.

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Abstract

This study investigates the aspects of resilience in the management strategies of the key stakeholders of flood risk management in the city of Accra, Ghana. The overall objective is to analyse the response capacity in the strategies of the key stakeholders in flood risk management for managing the unexpected course of flood disasters in addition to the expected features of flood risk. To achieve the set objective, the following research questions are addressed: Who are the key stakeholders of flood risk management in the city of Accra? How are these stakeholders dealing with the unexpected course of flood disasters in addition to the expected features of flood risk in their management strategies? How could the capacity of the strategies for responding to the unexpected course of flood disasters be advanced?

The inductive case study design applies document analyses, semi-structured interviews as well as key stakeholder identification and validation methods. Scientific and policy documents about resilience and flood risk management were reviewed. The research participants were mainly directors and representatives of organisations in flood risk management of the study.

Empirical findings include key stakeholders in flood risk management as well as aspects of resilience and anticipation in flood risk management strategies. The main finding on the key stakeholders of flood risk management are national, district, civil society, and private sector organisations as well as traditional authorities (local chiefs). Aspects of resilience in flood risk management strategies comprises omnivorousness, agile and timely flow of response resource, homoeostasis, flatness of the response structure and process, redundancy of the response resources and buffer capacity.

Findings revealed resilience regarding diversity in sources of resource and responses for dealing with unexpected course of flood disasters. The aspects of anticipation are described as resistance to known risk, maintenance of boundary conditions of the management strategies and specialisation for dealing with specific flood risk within and among organisations. Regarding anticipation, results indicate

that there are measures for resisting known flood risk but their implementation is ineffective.

Based upon the findings, hypotheses are derived for advancement of resilience and anticipation in flood risk management strategies. Involvement of the local chiefs, Slum Union of Ghana, Local Development Associations of flood-prone communities and key private sector organisations in flood risk management strategies in the city of Accra would amend their response capacities in diversity of sources of response resources and allow for advanced resilience regarding their responses to the impacts of land-use changes and the waste disposal in watercourses. Recommendations refer to prospects to advance the response capacity of key stakeholders of flood risk management strategies by integrating traditional authorities and private organisations in flood risk management in the city of Accra.

Keywords: flood risk management, stakeholders, management strategies, resilience, anticipation.

Kurzfassung

Diese Arbeit untersucht Aspekte von Resilienz in den Strategien von Schlüsselakteuren des Hochwasserrisikomanagements in der Stadt Accra (Ghana). Das übergeordnete Ziel besteht darin, das Reaktionsvermögen dieser Akteure in ihren Management-Strategien nicht nur hinsichtlich des erwarteten, sondern vor allem hinsichtlich des unerwarteten Verlaufs von Hochwasserkatastrophen zu untersuchen.

Die folgenden drei Forschungsfragen werden untersucht: Wer sind die Schlüsselakteure des Hochwasserrisikomanagements in der Stadt Accra? Wie berücksichtigen diese Akteure in ihren Management-Strategien den unerwarteten Verlauf von Hochwasserkatastrophen zusätzlich zu dem erwarteten Verlauf? Wie könnte das Reaktionsvermögen bezüglich des Umgangs mit dem unerwarteten Verlauf von Hochwasserkatastrophen in diesen Strategien ausgeweitet werden?

Im Rahmen des induktiven Fallstudiendesigns werden Dokumentenanalysen, halbstandardisierte Interviews und Gruppendiskussionen eingesetzt. Die daraus resultierenden empirischen Befunde beziehen sich neben der Identifikation der Schlüsselakteure des Hochwasserrisikomanagements auch auf die Aspekte von Resilienz und Antizipation in ihren Management-Strategien.

Zu den Schlüsselakteuren zählen nationale und lokale Organisationen, aber auch solche aus der Zivilgesellschaft, dem privaten Sektor und traditionelle Autoritäten. Bei den Aspekten von Resilienz in den Hochwasserrisikomanagement-Strategien handelt es sich um ganzheitliche Herangehensweisen, regen und zeitnahen Einsatz von Ressourcen zur Ereignisbewältigung sowie Pufferkapazitäten. Die Ergebnisse zeigten Widerstandsfähigkeit in Bezug auf die Vielfalt in den Quellen von Ressourcen und Antworten auf den unerwarteten Verlauf von Hochwasserkatastrophen. Die Ergebnisse hinsichtlich der Antizipation von Hochwasserrisikomanagement-Strategien umfassen den Widerstand gegen das bekannte Risiko, die Aufrechterhaltung von Rahmenbedingungen der Management-Strategien und die Spezialisierung auf bestimmte Hochwasserrisiken.

Auf den Erkenntnissen über die Aspekte von Resilienz und Antizipation in den Hochwasserrisikomanagement-Strategien aufbauend werden Hypothesen abgeleitet. In den Handlungsempfehlungen werden die Chancen einer Integration traditioneller Autoritäten und anderer Interessensgruppen in das Hochwasserrisikomanagement der Stadt Accra aufgezeigt, wodurch eine Weiterentwicklung der Resilienz in den Hochwasserrisikomanagement-Strategien für die Zukunft erreicht werden kann.

Stichwort: Hochwasserrisikomanagement, Akteure, Management-Strategien, Resilienz, Antizipation.

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List of abbreviations

A.M.A	Accra Metropolitan Assembly
CBOs	Community-Based Organisations
DVGs	Disaster Volunteer Groups
FEMA	Federal Emergency Management Agency
GAR	Global Annual Report on Disaster Risk
MMDAs	Metropolitan Municipal and District Assemblies
UNDP	United Nations Development Programme
NADMO	National Disaster Management Organisation
FRM	Flood Risk Management
FRMSs	Flood Risk Management Strategies
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
HFA	Hyogo Framework for Action 2005-2015
IFRC/RC	International Federation of Red Cross and Red Crescent
IPCC	Inter-governmental Panel for Climate Change
JICA	Japan International Corporation Agency
LDCs	Less Developed Countries
NSUG	National Slum Union of Ghana
OFDA	Old Fadama Development Association
UN/ISDR	United Nations International Strategy for Disaster Risk Reduction
USAID	United States Agency for International Development
WVI	World Vision International

1 Introduction

1.1 Background

Although floods have a long history in the world, their increasing occurrence and intensity in the Twentieth Century is unprecedented and therefore calls for innovative ways for dealing with their risks and impacts (ADCP, 2004; UNISDR, 2005; White, 2010; The Work Bank, 2012; IPCC, 2014; UNISDR, 2015). Existing management strategies aim to prevent and control floods but these are proving ineffective for the new dynamics of increasing flood risk (Kundzewicz & Takeuchi, 1999; Vis *et al.,* 2003; White, 2010). The increase in flood risk and impacts has led to the growing interest and consideration of the concept of resilience in flood risk management (FRM) strategies.

Floods need to be managed not only because their management is beneficial to society but also because it is impossible to eliminate floods (White, 2010). Antecedents of floods can be traced to ancient civilisations. For instance, floods were sources of alluvial soils for agriculture and the development of ancient communities along the Nile and Tigris rivers (White, 2010). Similarly, Franzi (2010) acknowledges flood as the main source of water and fertile soils for ancient civilisations. However, records indicate that the consequences and risks of flooding in modern societies have become more prevalent (The World Bank, 2012). Uncertainties associated with flood risk and impacts in modern society are obvious features that are difficult to control and therefore call for advancement in management (van Buuren & van Rooij, 2004). The chronic state of flood events and impacts is a challenge for researchers, policy makers and practitioners of FRM. This challenge calls for the consideration of resilience in FRM strategies (Handmer & Dovers, 2007; White, 2010), as it has the possibility of addressing the unforeseen courses of flood disasters and the anticipated ones (De Bruijn, 2005; Wardekker *et al*., 2010).

Conventional FRM strategies usually focus on anticipated courses of disasters and impacts. Their emphasis is on responding to determined flood risks and impacts. However, floods may come with unforeseen courses of disasters and impacts, which also require a special consideration in the FRM strategies (Handmer & Dovers,

2007). The next section explains the problem of flood risks and the need to consider resilience in FRM strategies using the city of Accra as a case study site.

1.2 Problem statement

The recurrence of flood disasters and their rising socioeconomic and environmental consequences has heightened the interest of organisations and academic communities to research on resilience of FRM strategies (De Bruijn, 2005; UNISDR, 2005; White, 2010; Resilience Alliance, 2010; Hutter, 2011; The World Bank, 2012; Kuhlicke, 2013). Flood disasters are one of the most prevalent of all natural disasters globally, with cities being the most threatened (Samuels *et al*., 2009; White 2010; Warner, 2011; EM-DAT, 2015). For instance, The World Bank (2012: 19-20) account of flood disasters contends that:

"in the past twenty years in particular, the number of reported flood events has been increasing significantly. The numbers of people affected by floods and financial, economic and insured damages have all increased too. In 2010 alone, 178 million people were affected by floods. The total losses in exceptional years such as 1998 and 2010 exceeded $40 billion. Urban areas at risk from flooding have been hit particularly hard by the observed increase of flooding impact across the world."

Similarly, Kundzewicz & Tacheuchi (1999: 417) describe floods as a major calamity, indicating that "… they have jeopardized settlements located, as a rule, near rivers." The authors illustrate that the "average annual flood losses worldwide have soared to several billion US Dollars. Yet, the experiences of this decade, including the flooding in Asia in summer 1998 at the Yangtze and Songhua in China, in Korea and Japan, India and Bangladesh, and elsewhere, keep reminding us that floods are indeed a major, and in fact, growing threat to societies" (*Ibid*: 431). Dworak (2008: 48) further demonstrates the impacts of floods using instances of heavy floods that hit Central and Eastern Europe in the year 2002 causing the loss of 100 lives, considerable economic loss and environmental damage, to further elucidate the problem. Handmer & Dovers (2007: 5-22) use examples of flood disasters in the USA, the Netherlands, Australia and Mozambique to demonstrate the seriousness and internationality of floods. The profile of floods outlined above, undoubtedly shows that FRM is a global challenge (White, 2010; The World Bank, 2012; GAR, 2014; IPCC, 2014). However, the flood problem seems to be more devastating in the

economically less developed countries than more advanced economies. Flood associated “deaths are concentrated in less developed countries” (O’Brien *et al*., 2006: 64) while huge economic losses accrue in the developed countries (UNISDR, 2005, The World Bank, 2009; Wisner & Pelling, 2009).

The International Federation of Red Cross and Red Crescent (IFRC/RC, 2010: 36) captures the above dynamic as follows: “Floods are most represented in the data, accounting for one-third of the total 3.3 million people affected by urban disasters in Africa” (also see Wisner & Pelling, 2009). Further, the IFRC (2002: 64) reports that “between 1992 and 2001, 27,464 and 594,899 fatalities occurred in middle income countries (MDCs) and low income countries (LDCs) respectively” as a result of floods. In Asia, flood incidents are reportedly rising (Hung *et al*., 2007; The World Bank 2012; GAR, 2015). Even though majority of the population of the developing world is located in Asia, Africa has the highest number of economically less developed countries. The lack of economic development and endemic poverty in most of these countries significantly contribute to their low capacity to respond to flood risk relative to the rest of the world (O’Brien *et al*., 2006; The World Bank, 2012). Flood risks in these countries have the tendency to worsen due to limited resources to address the underlying socioeconomic and environmental factors. A telling example is the work of Gwimbi (2009), which discusses the recurrence of floods in Southern African countries. Gwimbi (2009) concludes that, flood risk is a major challenge in those countries and has a potential to degenerate in the future.

The problem of flood risk in Africa is particularly predominant in the cities, where the urban poor and infrastructure are most vulnerable (Douglas, 2008; Rain *et al*., 2011; The World Bank, 2012; GAR, 2015). Douglas *et al*. (2008: 190) conclude from classic cases of flood disasters in the cities of Accra, Kampala, Lagos, Nairobi and Maputo that, “urban flooding is becoming an increasingly severe and a more frequent problem for the urban poor”. They cited examples of the 2000 floods in Maputo and Motala in Mozambique and, the 2002 floods in East Africa that killed at least 112 people. The assertion is that flood risk is also a problem in cities of African countries. Cities in West Africa are not free from the rising flood risk and impacts. Tschakert *et al.* (2008) explain that floods are a problem in countries of West Africa and cite the 2002, 2003, 2005, 2006, and 2007 flood disasters that caused loss of lives and damage to property across Burkina Faso, Togo, Ghana and Nigeria.

Diagne (2007) and Adelekan (2010) further illustrate this point with their work on the vulnerability of the cities of Lagos in Nigeria and St. Louis in Senegal to floods respectively. Although these studies seem to confirm that flood risk and impacts affect urban poor in the respective study areas, the problem can cut across many other countries.

Consistent with the observed increase of flood risk and impacts in the developing world, there is an increase in flood risk and impacts in parts of Ghana. Tschakert *et al*. (2009), whose work is more extensive on flood risk and impacts in West Africa note that Ghana was one of the hardest hit countries of the October 2007 flood disaster. Furthermore, other studies point to flood risk in Ghana as a national problem and highlight that it is more disturbing in cities than in rural areas (The World Bank, 2003; Addo *et al*., 2011; Rain *et al*., 2011; UN-Habitat, 2011; Oteng-Ababio, 2013). Examples of flood disasters in Ghana include the 1995, 1997, 1999, 2000, 2002, 2007, 2009, 2011, 2012 and 2015 events (Karley, 2009; Rain *et al*., 2011; Okyere *et al*., 2013; Gyekye, 2013; Amoako & Boamah, 2015).

Discussing issues of flood risk and impacts in Ghana will be incomplete without mentioning the city of Accra as a case. Accra is the most illustrative example due to its protracted proneness to flood risk and impacts (Karley, 2009; Rain *et al*., 2011). Rain *et al*. (2011: 13) argue that "significant flood events have been recorded in 1973, 1986, 1995, 1999, 2001 and 2002" in the city of Accra. Using hydrological model and geographic information system to map flood risk zone in Accra, Nyarko (2002: 11-12) observes that "the high flood risk zone covers 35.66 per cent of the study area" and neighbourhoods "mostly below the 350 meter contour" having "a high likelihood of periodic floods." Other studies show that flood risk in Accra became a problem from the mid-1990s, but is now an annual event (Nyarko, 2002; Gyekye, 2011; Okyere *et al*., 2013; Amoako & Boamah, 2015). Reports of organisations that deal with flood risk and impacts in Ghana also indicate that flooding is a major problem in Accra. For example, the National Disaster Management Organisation (NADMO) and the Hydrological Services Department of Ghana indicate that flood risk and impacts in the city of Accra keep increasing annually (Ghana Hydrological Services Department 2009, 2010, 2011; Ametefe, 2013; NADMO, 2010, 2013).

Changes in climate and societal development are also seen as major drivers of flooding (Mirza, 2003; ActionAid, 2006; Tschakert *et al*., 2007; White, 2010;

Olorunfemi, 2011; Rain *et al*., 2011; Steffen *et al.*, 2013). Policy documents and scholarly works further point to climate change as a reason for the increase in the disasters and the frequency of flooding in urban areas over the past decade (Rain *et al*., 2011; The World Bank, 2012; IPCC, 2014; UNISDR, 2015). According to the IPCC (2014: 8) "there are likely more land regions where the number of heavy precipitation events has increased than where they have decreased. Recent detection of increasing trends in extreme precipitation and discharge in some catchments implies greater risks of flooding at regional scale." The argument is that climate change has an impact on the increase in rainfall that can result in the inundation of urban settings previously unknown to flood disasters. Accra is one of the cities of Africa with high flood risk due to the impacts of climate change (Douglas *et al*., 2008; ISDR, 2009; UN-Habitat, 2009; Gyekye, 2011; Rain *et al*., 2011). Projecting based on a worst-case scenario, Addo *et al*. (2011: 2044) contend that, by the year 2100, "over 200 m of coastal land could be lost in Accra" and "flooding due to storms and high spring tides could periodically engulf a much greater area" due to the impacts of climate change. This scenario explains the enormity and increasing trend of flood risk in Accra.

The impacts of climate change include variability in rainfall patterns and intensity can affect flood hazard. If rainfall intensifies and its peak season becomes longer than before without requisite FRM strategies to contain volumes of water, flood hazard can increase. However, records of rainfall in Accra between 1960 and 2010 do not suggest any increase in rainfall intensity but slight changes in the period of rainfall seasons (Ghana Meteorological Agency, 2010; OCHA/UNEP, 2011, Gyekye, 2013). There are also suggestions of changes in the patterns of rainfall seasons leading to floods in off rainy seasons when preparedness for flood risk is low. A study conducted by OCHA/UNEP (2011: 8) about the 26th October 2011 flood disaster in the city of Accra shows that, "even though the rains and floods are perennial this heavy rain came in off season, at the end of October. Since the preparedness for a flood in late October was low, the effects of the flood were pertinent." The NADMO report of the same year indicates that, the 10th February 2011 flood disaster in the city of Accra occurred after a peak rainy season (NADMO, 2011). These records show changes in the expected periods and magnitude of floods, which can also be described as unexpected changes. The floods usually occur in Accra from May to

June and July to August during the peak and low rainy seasons respectively. However, the trends seem to be changing over the past decade as flood could occur in February, October and November. In addition, high peaks of rain could cause flooding with magnitudes similar to floods in the period of June, the major annual rainfall season.

Other debates claim that societal changes, especially land-use change, are responsible for the increase in flood risk and impacts in urban areas (Afeku, 2005; Diagne, 2007; Douglas *et al*., 2008; Karley, 2009; Adelekan, 2010; Rain *et al.*, 2011). The focus of this argument is that, urbanisation precipitates increases in physical developments, which in the case of developing countries, often comes with poorly regulated spatial land-use, leading to developments on waterways and sealing of the natural land surface with concrete. The infiltration of rainwater is reduced as a result, while haphazard runoff is increased. These issues can cause flooding during a rainstorm. For instance, Adelekan (2010: 448) attributes flood risk in the city of Lagos to urbanisation and explains that the "metropolitan Lagos is expanding rapidly both in area and population, with a concomitant increase in the urban poor population in (coastal) areas being at risk of flooding." Similarly, the city of Accra has expanded both in built-up area and population, and this expansion is a recipe for the increase in flood risk and impacts (Town and Country Planning Department, 1962, 1991, 2012; Yankson & Grant, 2003; Afeku, 2005; Karley, 2009; Rain *et al*., 2011). Rain *et al*. (2011: 8-9) argue that the city of Accra has experienced an average population growth rate of 4.3%. Their study also reveals a spatial expansion of the city from 1900 to 2000, with most of the open spaces currently being occupied by slums. This expansion of Accra in space and population implies wetlands and watercourses are converted to residential land use. Open drains are also filled with urban waste, disrupting the free flow of water from rainstorm (Karley, 2009; NADMO, 2009, 2010, 2011, 2012; Hydrological Services Department, 2011; OCHA/UNEP, 2011; Ametefe, 2013). These societal developmental changes tend to increase the determined flood risk. This consequently has the potential of producing unexpected flood hazard and vulnerability, resulting in unforeseen course of flood disasters (Johnston *et al*., 2006).

As in other natural disasters, unforeseeable impacts are common characteristics of flood events, manifested as unexpected impacts on lives and property leading to a

breakdown infrastructure and response resources (Comfort *et al*., 1994; Wachtendorf & Kendra, 2004; Johnston *et al*., 2006). Unforeseeable course of flood disasters could take various forms. An unknown (unforeseeable) course of a particular flood event with its consequences may originate from real pattern of a flood event when it occurs. For instance, the typical features, such as the duration and the impacts, of flood events of the same return periods may change when it occurs. Moreover, possible long-term change also include "surprise" of boundary conditions for future flood events with the resulting consequences due to climate change or societal developments (UNISDR, 2005; GAR, 2009; White, 2010; The World Bank, 2012).

During a flood disaster, an unforeseen course may lead to a breakdown of infrastructure such as communication network, electricity, water, drainage systems and response facilities, due to "implicit uncertainty" (Paton & Johnston, 2006:16). Diagne (2007) notes that collapse of bridges, blockage of waterways and a shortage of shelter are common unforeseen impacts of flood disasters. A shortage of relief items and breakdown of critical infrastructure such as electricity, water and communication among other utility networks can exacerbate disasters (OCHA/UNEP, 2011). Furthermore, Johnston *et al*. (2006: 40-64) in case studies of separate flood and earthquake incidents in New Zealand revealed that critical infrastructure, which they described as "lifelines", got disrupted unexpectedly in each case. They advocate that an application of resilience in risk management can help to deal with such situations. Kuhlicke (2013) applies resilience to study emergency flood management of the 2002 Elbe River flood event. His study suggests that unexpected flood risk and impacts are part of a running flood event and require resilience in the response strategies of FRM organisations.

Scholars also raise concerns about incapacity of existing FRM strategies to cope with unforeseen impacts of flood events and the need to consider resilience in these management strategies in the future (De Bruijne *et al.,* 2010; The World Bank, 2012; UNISDR, 2015). FRM strategies are usually formulated based on the probability of determined flood risk. Such strategies include structural and non-structural FRM measures (Amman *et al.,* 2006; Hutter, 2007; Hutter & Schanze, 2008; Franzi, 2010; Renn & Aven, 2010). Sometimes, a non-response, as in doing nothing, to flood risk is also a strategy. The structural measures are physical engineering works such as

drainage channels, dykes, and water retention ponds (Kundzewicz & Takeuchi, 1999). The non-structural measures, consisting of flood maps, FRM policies and standards, building codes and land-use regulations control flood hazards and regulate flood vulnerabilities to make room for floodwater (White, 2010). Usually, these strategies are formulated and implemented in anticipation of determined features of flood risk (Thus, no changes would occur to the anticipated flood risk and impacts during floods). The question of dealing with the unexpected flood impacts is not considered and can become an opening for increase in flood risk and impacts during flooding. Besides, the unexpected flood risk also has to do with residual risk, which partly remains uncertain and needs to be tackled with resilience in FRM strategies (Handmer & Dovers, 2007; Johnston *et al*., 2007).

Stakeholders in terms of organisations in FRM and their response capacity for dealing with flood risk and impacts are relevant on the issues of floods (Futaki, 2010; Reed *et al*., 2010). FRM involves a range of activities of societal analysis, evaluation and reduction of flood risk (Schanze, 2006). These activities span across the phases of pre-flood, flood event and post- flood disaster management (Kundzewicz & Takeuchi, 1999; Amman *et al*., 2006; Schanze, 2009; Samuels *et al*., 2009; Renn *et al*., 2010). The stakeholders play roles as individuals, communities and representatives of public and private organisations (Schanze & Hutter, 2008; Futaki, 2010). However, the final decision-making on FRM strategies is in the authority of the key organisations that deal with flooding (Bryson, 2004; Reed *et al*., 2009). For instance, community, water resources, land-use planning, humanitarian and emergency management organisations have various roles to play in FRM. Likewise, the media, politicians, flood-prone communities, security agencies and non-governmental agencies engage in different activities in FRM (WMO, 2007; Reed *et al*., 2009; The World Bank, 2012). With these diverse actors, lack of coordination of stakeholder activities and clear definition of roles can be challenges in FRM that cause confusion and underperformance (Kasanga, 1991; Songsore *et al*., 2001; Afeku, 2005). Handmer & Dovers (2007) expatiate on the issue of confusion over roles and coordination of activities, using the 2000 flood in Mozambique and the 2005 Hurricane Katrina in New Orleans. Stakeholder theory offers an opportunity to define the course of flood disasters with various stakeholders and their interrelations in the design and implementation of FRM strategies (Bryson, 2004; Reed *et al.,*

2009). Stakeholder concept can help to identify the legitimacy, roles, influence and urgency of the main players in FRM (Lebel *et al*., 2006; Reed *et al*., 2010). The application of stakeholder concept in this research allows for the identification of key stakeholders in FRM, which becomes a pivot around which resilience in FRM strategies evolve.

Resilience commonly refers as the capacity of a system to bounce back or return to stable state in the face of disturbances (Resilience Alliance, 2010). The seminal works of Holling (1973, 1996) in ecology interpret resilience in a positive sense implying persistence in, resistance to, and recovery from disturbances. Resilience in the context of disturbances to stable or normal functioning conditions of individuals, engineered structures, society and natural environment. It can also be a useful concept for explaining the capacity of stakeholders in response to the unforeseen course of disasters (see Comfort and Kendra, 2003; McManus *et al*., 2007; Comfort *et al*., 2010; Hutter, 2011). Wildasvky (1991) contends in this view that, resilience can be a meaningful concept for analysis of public policy in risk management. De Bruijne (2005) investigated resilience of FRM in the Netherlands with emphasis on the physical flood risk measures. Klijn *et al*. (2004) argue for flood resilience as opposed to flood control in the management of floods in the Rhine River in the Netherlands and contend that the former targets to reduce flood hazards instead of focusing on flood control or prevention.

Other publications make claims about potential gains of resilience in disaster risk management but argue that the concept poses theoretical and application difficulties to researchers (Adger, 2000; UNISDR, 2005; Resilience Alliance, 2010; Woltjer & Kranen, 2011; The World Bank, 2012). Despite these challenges, the concept of resilience is popular in various disciplines for its positive implications in organisational management of risk. For instance, Liao (2012) argues for urban resilience to flood risk as an alternative to flood control measures. However, in disaster risk management and FRM, in particular, resilience seems not to be widely researched (UNISDR, 2009; Hutter, 2011; Mitchell and Harris, 2012). Particularly, existing research focuses more on resilience of structural measures of FRM in advanced countries than developing nations (De Bruijn, 2001, 2004, 2005; Wardekker *et al*., 2010; De Bruijne *et al*., 2010; Hutter, 2011). The non-structural dimension of FRM is under-researched. Research on resilience in FRM strategies,

focusing on dealing with the unexpected course of flood disasters in addition to the expected features of flood risk using a typical case study from a developing world city is not done yet.

This research investigates resilience in the strategies of key stakeholders of FRM for responding to the unexpected course of flood disasters in addition to the expected features of flood risk in the city of Accra. The focus is to understand and describe resilience in the FRM strategies of key stakeholders for dealing with the unexpected course of flood disasters and the expected features of flood risks. Accra is the capital city of Ghana, located in Africa. With a total population of 4.3 million people, Accra is like other cities in the developing world facing flooding problems (Songsore *et al*., 2009; UN Habitat, 2009; The World Bank, 2012). The population of Accra region was 2,905,726 in the year 2000 but increased to 4,010,054 in 2010 with an intercensal growth rate of 3.1% (Ghana Statistical Service, 2012: 2). Topographically, Accra is a coastal plain and stands at about 400 metres above sea level. The city has experienced a high rate of urbanisation for some time now. Accra has a bimodal rainfall pattern and it is estimated that about 41% of its surface area lies between high and medium flood risk zones as of the year 2000 (Nyarko, 2001).

In response to flood risk in the city of Accra, there have been management interventions from disaster risk management organisations (Songsore *et al*., 2005; Karley, 2009; Ametefe, 2013; Okyere *et al*., 2013). The interventions include structural and non-structural measures. In Ghana, FRM is included in the activities of disaster management organisations. National Disaster Management Organisation (NADMO) of Ghana coordinates the organisations and their activities of FRM. It is the legal mandate of NADMO to coordinate international, national, regional, district and local community organisations to manage flood risk (The Acts of Parliament of Ghana, 1996 NADMO Act 517; Afeku, 2005; NADMO, 2009, 2011, 2012). The Metropolitan Disaster Management Plan of Accra (NADMO, 2010) provides details of organisations responsible for managing all natural and human-induced disasters and impacts. The management of flood risk is included in the disaster risk management plan of Accra. Spatial land-use plans and policy documents also attempt to control flood hazards and regulate flood vulnerabilities through land use regulations and building codes (Afeku, 2005; Karley, 2009). The land-use plans of the 1952, 1962, 1991 and 2012 are master plans of Accra that include the drainage of the city.

Moreover, the Ghana Building Codes and Standards of 2010 is a document that provides regulations for development of structures in flood prone areas. Additionally, the national legislation Act 517 of 1996 that establishes the NADMO allows international and national organisations to coordinate FRM.

Attempts to prevent floods through physical measures and programs exist in Accra. As outlined by Ametefe (2013) in a report on the drainage master plans of Accra, the 1963 NEDCO Drainage Master Plan focuses on the central business district of Accra. The Messrs Mott MacDonald and Messrs Watertech Ltd in 1990 update this plan. The 1997 Urban Environmental Sanitation Project of the Ministry of Local Government and Rural Development, through SNC Lavalin Ltd., further reviewed the previous plan, leading to the construction of primary and secondary drains in Accra (Ametefe, 2013). Another review of the drainage plan took place in 2006 by the Ministry of Local Government and Rural Development in Ghana. The latest flood intervention project is the Accra Sanitary and Storm Drainage Alleviation Project commissioned in 2013 by the Government of Ghana through the Ministry of Water Resources, Works and Housing. This project, undertaken by the Messrs Conti International, aims to reduce flood risk through dredging of the Odaw drain, construction of other drains and management of waste. Besides the land-use regulations and channelisation, there have also been resettlement programs in the form of evictions and relocations, public education and sensitisation, and emergency response in FRM (NADMO, 2009, 2010).

However, the interventions to flooding in Accra are ineffective and have implementation limitations due to inadequate resources, poor coordination of stakeholder activities, and uncertainties of climate and societal changes that are believed to contribute to the increase in flood risk (Karley, 2009; Gyekye, 2013). There have been some researches on flooding in Accra but the topic about resilience in FRM strategies has not been tackled. The works of Nyarko (2000, 2002) for instance, map out flood risk areas in Accra. Rain *et al*. (2011) explain flood risk from climate change impacts on migration and unregulated urbanisation with results of flood risk maps of Accra emphasising slum communities. OCHA (2011) focused on rapid appraisal of the 2011 flood event in the city of Accra. Afeku (2005) and Karley (2009) have addressed the causes of flood risk from planning perspective. Okyere *et al*. (2013) explain flood vulnerability in Accra from political ecology perspective.

Amoako & Boamah (2015) address three-dimensional causes of flooding in the city of Accra to explain the political, economic and environmental forces of the chronic flood risk in the area. Some studies focused on specific neighbourhoods of Accra to explain the flood problem (Addo *et al*., 2011; Gyekye, 2011). Owusu *et al*. (2012) from hydrological engineering emphasised on reservoir storage for dealing with extreme floods in Accra, using the case of the Dzorwulu Basin. In all of these works, resilience in FRM strategies in Accra is not addressed. Research on floods in the study site has focused on other issues of flood disaster risk (Gough & Yankson, 2001; Yankson *et al*., 2003; Afeku, 2005; Songsore *et al*., 2005; WMO, 2006; NADMO, 2010; UN-Habitat, 2011).

The missing point in these studies on flooding in the city of Accra is the application of resilience in FRM strategies. There is need for knowledge about resilience in FRM strategies because floods often come with surprises and random course, which can increase disasters. Hence, it is appropriate to consider the response capacity of the key stakeholders in the FRM strategies, which is designated as resilience. Resilience is to tackle unknown, unforeseeable course of a particular flood event with its consequences. Unintended course of disaster in a flood event due to, for example, blockage of culverts and extreme events such as a probability higher than 500 years return floods. Possible long-term changes of future flood events with the resulting consequences due to climate change or societal developments can also fall within unexpected course of flood disasters resilience in FRM strategies can address (GAR, 2009; White, 2010; The World Bank, 2012).

1.3 Objectives and research questions

The main objective of this research is to identify the key stakeholders of FRM in the city of Accra and to analyse the resilience in their management strategies for dealing with the unexpected course of flood disasters in addition to the expected features of flood risk. This research contributes to the concept of resilience in FRM strategies. The research also provides a practical direction for advancing resilience in the FRM strategies key stakeholders of the study site. Resilience is understood here as the capacity of responding to the unexpected course of flood disasters in addition to the expected features of flood risks. This objective addresses the main research question: What is the response capacity of the key stakeholders of FRM with respect

to their strategies for dealing with the unexpected course of flood disasters in addition to the expected features of flood risk in the city of Accra?

Response capacity refers to resilience in FRM strategies of the key stakeholders. Resilience in FRM strategies is not seen in isolation; it is considered along with the strategies based on anticipation in the FRM. Anticipation strategies may refer to land-use regulations, policies, engineering measures, and inter-organisational arrangements in response to expected flood risk and impacts. Anticipation in FRM strategies is in response to determined flood hazard, vulnerability and exposure. However, possible changes in the course of flood disasters could result in unforeseen flood impacts. Rresilience in FRM strategies deals with unforeseen changes in a flood event.

This research addresses three specific research objectives. For convenience and sense of direction, each research objective has a corresponding research question (RQ). These objectives with the research questions are the following:

- First, to identify and describe the key stakeholders of FRM in the city of Accra.

  RQ 1: Who are the key stakeholders of FRM in the city of Accra?

- Second, to analyse the capacity of these stakeholders in responding to the unexpected course of flood disasters in addition to the expected features of flood risk in their management strategies.

  RQ 2: How are these stakeholders dealing with the unexpected course of flood disasters in addition to the expected features of flood risk in their management strategies?

- Third, to derive hypotheses on the meaning of resilience aspects for the advancement of the FRM strategies in the city of Accra.

  RQ 3: How could the capacity of the strategies for responding to the unexpected course of flood disasters be advanced?

Each of the research questions is further elaborated for clarity and specificity.

RQ 1: Who are the key stakeholders of flood risk management in the city of Accra?

This research question seeks to identify and analytically describe the key stakeholders in FRM in the city of Accra. The target of this question is to select key stakeholders who play major roles in FRM in the city of Accra. Data on the key stakeholder organisations and their legitimate specific roles of FRM in the city of Accra are sought to answer this research question. The purpose of the question is to accomplish the first objective of the study. The conceptual basis of this research question is stakeholder theory whilst the data analysis method is stakeholder analysis. There is no fast rule for doing stakeholder analysis; it all depends on field of study and the objective of the research question. The interest and interrelationships of stakeholders also assist in stakeholder identification as Futaki (2010) posits.

RQ 2: How are these stakeholders dealing with the unexpected course of flood disasters in addition to the expected features of flood risk in their management strategies?

The second research question is exploratory and aims at addressing the second objective of this research. This question seeks to describe underlying patterns of the strategies of key stakeholders in FRM for responding to the unexpected course of flood disasters in addition to the expected features of flood risks. The question aims to identify and understand aspects of resilience to emphasise the capacity for responding to the unexpected course of disasters. The question finds out the individual and inter-organisational response capacities for tackling the unexpected course of flood disasters and the expected features of flood risk and impacts. Data on the resource capacity and strategies for mobilising additional resources are relevant for the research question two. Response capacity hinges on the available financial, technical, material and human resources of the stakeholder organisations for responding to the underlying causes of unexpected disasters.

Resilience in FRM strategies indicates the capacity of response to unexpected course of flood disasters. Resilience reflects the management strategies for dealing with flood risk and impacts without knowing beforehand the exact details of the occurrence and the consequences of a specific flood event (Wildavsky, 1991). Resilience can reflect in diverse kinds of stakeholders and pathways to discharge

resources in response to the unexpected courses of flood disasters in addition to expected impacts of floods. Moreover, awareness of flood risk of the managers through sharing of information and learning can be an aspect of resilience in FRM strategies. A fast distribution of resources and timely response to the course of unexpected flood disasters are also relevant for resilience. Resources can also be set aside as a backup for response to unexpected course of flood disasters to achieve resiliency. These emergency response resources become backup response resources. The flatness in FRM strategies in terms of decentralising responses to flood risk can be useful for resilience to unexpected course of flood disasters. Data on these aspects of resilience in FRM strategies could be relevant for addressing the research question 2 (McManus *et al*., 2007; Weick, 2007; Stephenson *et al.*, 2010). It is crucial define features of the FRM strategies to tackle the consequences of floods that exceed the determined probabilities of flood occurrence and impacts. Resilience in FRM strategies is generic and cuts across the spectrum of the analysis, assessment and reduction of flood risk.

In this research, the concept of resilience in FRM strategies also considers strategies for dealing with expected flood risk. Response to expected features of flood risk and impacts is also part of this research question. The expected features of flood risk and impacts fall on the anticipation dimension of the research question. The researcher requires data to explain strategies in the FRM for responding expected flood risk. Data on the strategies for responding to expected features of flood risk are important to consider. For instance, putting in place safe havens, policies and plans in addition to programmes for reduction of flood hazards, vulnerabilities and exposure can be relevant. Flood risk may require special expertise, which needs specialisation of specific sectors in the management.

RQ 3: How could their capacity of responding to the unexpected course of flood disaster risks be advanced?

The objective of the RQ 3 is to derive hypotheses on potential advancements of the response capacities and recommendations for the FRM strategies in Accra. The hypotheses are derived from the empirical findings on the RQ 2. Mainly, the hypotheses are derived from empirical findings of lack (low) indications of particular aspects of resilience in the FRM strategies as described in the conceptual framework of this research. Similar kinds of hypotheses are derived on the aspects of

anticipation of the FRM strategies. Results on the aspects of resilience in FRM strategies for responding to unexpected course of flood disasters are described in the development of the hypotheses. This process also included the aspects of anticipation in FRM strategies in response to the expected features of flood risk and impacts. The question looks at how these challenges could be overcome through improvements on aspects of resilience of the FRM strategies. The question of what opportunities exist for improving the relationship among stakeholders in their activities are thought through in the hypotheses formulation and the possibilities for testing these hypotheses in future research. The potential improvements of the response capacities of the key stakeholders to reduce flood risks are expressed in the hypotheses.

1.4 Justification of the study

The choice of the city of Accra for this research is relevant for several reasons. Accra is a densely populated city with a high risk to flood disasters relative to other cities in Ghana and West Africa (Rain *et al.,* 2011). In addition, Accra has the largest slums and highest rate of urbanisation with land-use regulation challenges in Ghana (Rain *et al*., 2011). These societal changes culminating in the issues of climate change, the risk of flood is likely hype in the future to cause more devastation. Thus, a study on resilience in the management of flood risk is a timely call. As the national capital of Ghana, Accra houses the main national socioeconomic and political infrastructure. Government ministries, high commissions and embassies, agencies, headquarters of multinational corporations and organisations are all located in Accra. Accra is a primate city of Ghana, where infrastructure for socioeconomic development and connections to international community are established (Songsore, 2003). The threats of flood events have significant impacts on domestic and international activities, and need an innovative approach of resilience.

In anticipation to contribute to future research, the hypotheses for advancement on resilience in FRM strategies can inform future studies in similar context. The framework for operationalisation of resilience in FRM strategies can apply similar cities facing flood risk as in Accra. Beyond, the framework may also generate scientific discussion in the field of resilience in FRM strategies in the future.

This research also focused on the management strategies of key stakeholders, which are not clearly addressed in the field of study. Multiple organisations participate in the management of floods but not all of them are main players in decision-making and implementation of strategies. Clear definition of the key stakeholders of FRM strategies can ensure effective performance in response to flood risk (O'Brien *et al*., 2006; Handmer & Dovers, 2007). Clear definition of the key stakeholders is assumed as a backbone around which resilience in FRM strategies can evolve.

1.5 Structure of this research

This research has eight chapters. Chapter 1 introduces the background to the study, the problem statement, the research questions as well as the overall objective and specific objectives of the research. Presentation of the structure of the thesis is included in this chapter. Chapter 2 outlines the theoretical background of this research. This framework guided the data collection and analysis of the results of this research. This approach is in line with the assertion that concepts are a framework of the theory and the empirical research (Babbie, 2012). The description of basic concepts sets grounds for detailed discussion of FRM approaches. Stakeholder theory and the concept of resilience are discussed in the context of FRM. The discussion incorporates general theoretical background and operational indicators of FRM. Theoretical and operational difficulties of the concepts in research on disaster risk management are also pointed out. The conceptual framework is a reference point for the presentation and interpretation of the results of this research.

Chapter 3 focuses on the research design and methods of the thesis. This chapter explains how the empirical data were obtained, analysed and presented. Overall, it describes the case study research design as well as semi-structured expert interviewing and content analysis as employed in this research. The specific methods for answering the research questions are outlined. These methods encompass tools and techniques for data collection and analysis. Sources of data and approach to interpretation of results are explained. Sampling technique for selecting research participants and obtain secondary data is central to this chapter. Essential to qualitative study is ethical values and norms guiding data acquisition, handling and use. In addition, the chapter describes the research ethics that guided

this study. The challenges of the research design and methods, as well as the strategies to minimise them for positive results are also outlined in this chapter.

In Chapter 4, results on the key stakeholders of FRM are presented. Relying on the broad definition of the stakeholder concept, the scope of stakeholders of FRM in Accra consists of groups, communities, organisations and individuals. The key stakeholders in FRM are analytically selected, using the factors as discussed previously in this research. The chapter provides results that reflect the concept and the analysis of stakeholders as basis for understanding and the application of key stakeholders in the research.

Chapter 5 is the empirical findings regarding the second objective and its corresponding research question 2. It reflects the aspects and indicators of resilience in the FRM strategies from the conceptual framwork in Chapter 2. The details of the findings also include aspects of anticipation in the FRM strategies. Chapter 6 focuses on the third objective to answer the research question 3. The central discussion in this chapter is about the hypotheses on advancing the resilience aspects in FRM strategies from the empirical findings. Concepts, theoretical constructs, and propositions that underlie hypotheses development are referred. This follows a discussion of the results in the Chapter 7. The discussion of the empirical findings iteratively refers to the concept and framework of FRM, stakeholder concept as well as resilience and anticipation of the FRM strategies. The presentation includes findings of this research that confirm or contradict results from other scholarly works in the field of study.

Chapter 8 is the conclusions and recommendations of this research. The chapter reflects on the key findings of the research and provides recommendations for future research work and practice of FRM strategies of the study site and the field in general. Recommendations are made from insights of the key findings and the hypotheses for future research and practical work on FRM. The recommendations preliminarily aim at enhancing the capacity of the key stakeholders to respond to the unexpected course of flood disasters in the city of Accra.

In summary, Chapter 1 introduces this research topic and elaborates on the background, the problem statement, the research objectives of the specific research

questions, the justification and the structure of this study. The next chapter is on the conceptual framework of this research.

2 Conceptual framework

Conceptual definitions form the theoretical basis and an initial step of a shared understanding of a scientific work. The definitions give clear conceptual bearings of the research (Klijn *et al*., 2008; Franzi, 2010). The conceptual framework captures basic terms in FRM; stakeholder theory and resilience as a theoretical background of this research. The conceptual framework contributes to this study through connecting concepts with real world FRM strategies. The research objectives and questions demonstrate this connection, which further serves as a basis for the research design and methods. The conceptual framework guided the data collection and analysis, as well as the interpretation of the empirical findings. Explanation of key terms and concepts are the starting point of the framework. Terms and concepts in FRM are first described, followed by the concept of resilience and anticipation. This conceptual discussion is a foundation from which the researcher operationalises the aspects for describing resilience (in addition to anticipation) in FRM strategies. The logical sequence of the conceptual discussion begins with the fundamental concepts in FRM as in following sections.

2.1 Basic concepts in flood risk management

Policy instruments such as the European Union (EU) Floods Directive, as a policy regulation (EU Directive 2007/60/EC, 2009) uses certain definitions for concepts in FRM which are related to the ones scholars in the FRM research field use (Schanze, 2006; Samuels and Gouldby, 2009). Section 2.1 has the following sub-sections. Section 2.1.1 explains the concept of flood risk. This explanation defines flood hazard, flood vulnerability, exposure and flood risk. Section 2.1.2 differentiates between the expected features of flood risk and the unexpected course of flood disasters. FRM is described in section 2.1.3 similar to the meaning of management applied in business organisations. Section 2.1.4 addresses FRM strategies. Section 2.1.5 defines perspectives of stakeholder in FRM strategies. Various definitions and interpretations of stakeholder theory are reviewed for detail understanding of the concept. Finally, risk governance discussed to bring out a broader scope beyond FRM. Understanding the concepts of flood risk and FRM is useful for deriving the conceptual frame for the aspects of resilience in FRM strategies. The next section begins with the concepts of flood risk.

2.1.1 Flood risk

Flood hazard, vulnerability, and exposure are crucial in discussing the concepts of flood risk. The concept of flood is defined differently in policy instruments and international scientific literature (Franzi, 2010: 237). The European Directive on the Assessment and Management of Floods (Directive 2007/60/EC), a policy instrument, defines flood as "the temporary covering by water of land not normally covered by water." Flood is therefore, not a permanent phenomenon; an area that remains flooded permanently turns into a water body. A flood occurs when water from a source inundates a dry land area. Flood is a relatively high flow of water, which overflows the natural channel provided for runoff (Afeku, 2005). Samuels *et al.* (2009: 25) define flood as temporal covering of land by water outside its normal confines. This definition considers all possible types of floods and it sounds relevant for this research (Samuels *et al.,* 2009; Schanze, 2009).

Flood is classified based upon its source and special characteristics of the flood event (Schanze, 2006; MWO, 2007; The World Bank, 2012). High precipitation, high tides, snowmelt, reservoir failure, tsunamis and storm surges can cause inundation of natural floodplains (Schanze, 2006). The World Meteorological Organisation (WMO, 2007: 16) acknowledges the general impacts of floods in society, but stresses that flash floods are particularly dangerous in cities. Flash flood have been described in that context as having the capacity to rush at high speed, cut off underground tunnels, depressions and escape all watercourses to appear in places that usually do not experience flooding (ibid). Flash flooding is common in mountainous areas and desert regions, and lasts for short periods. Blockage of watercourses and sewer by debris can impede the intake and flow of water to cause flash floods when there is excess water from upland (Samuels *et al*., 2009). Fluvial floods occur due to poor infiltration. Cities face plain floods from large rivers, coastal floods from storm surges, pluvial floods from local heavy rainfall and sewer floods from overflow of sewer systems.

The concept of flood hazard is also important in the discussion of floods. The UNISDR (2009: 17) defines a hazard as "a dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage." Floods are hazardous to society as they have a potential to

cause loss of lives, property, social values, environmental damage services and economic productivity (Songsore *et al*., 2005; Aven & Renn, 2010; Gyekye, 2011). Flood hazard refers to the likelihood of the occurrence of a flood event with its potential to lead to harm (IRGC, 2005; Schanze, 2006: 2; UNISDR, 2009). Physical force, debris and chemical components of floods can cause damage and loss to valued elements.

The concept of flood vulnerability is also important in the context of floods. Vulnerability in itself is defined variously in the literature (Thywissen, 2006). The UNISDR (2009: 30) considers vulnerability as "the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard." Flood vulnerability can therefore; refer to the inherent characteristics of a floodplain that make it susceptible to flood hazards (also see Schanze, 2006; Blanco-Vogt & Schanze, 2014). Blanco-Vogt and Schanze (2014: 592) aptly define flood vulnerability as "the conditions determined by physical, institutional, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards." It is further understood as the combination of susceptibility, societal value or function and coping capacity of elements exposed to flood hazard (Schanze, 2006; Amman, 2010; Blanco-Vogt & Schanze, 2014; IPCC, 2014; Rufat *et al.,* 2015). This definition excludes exposure from the concept of vulnerability. Thywissen (2006: 17) explains that exposure refers to "the number of people, and the value of structures and activities that will experience" hazards, and may be adversely affected by this experience (also see Davidson and Lambert, 2001; ADRC, 2005).

Exposure is the proneness of vulnerable elements to flood hazard such as people, property, goods that can be lost, injured or damaged during flood event (UNDRO, 1984; Franzi, 2010: 239). Flood hazard, vulnerability and exposure constitute the concept of flood risk. The concept of flood risk can be understood in various ways. It includes the intensity and probability of flood occurrence, loss and damage due to flood hazard and vulnerability (Franzi, 2010: 238). The World Meteorological Organisation (WMO, 2009) considers such issues, and defines flood risk as "potential losses associated with a flood hazard or an extreme event to a given place within a given period of time, which can be defined in terms of adverse consequences (damage/losses) and the probability of occurrence." Simply put, flood

risk is understood as the probability of negative consequences due to floods (Schanze, 2006; Samuels *et al.,* 2009). It is the probability of the potential harm caused by flood event to elements vulnerable to flood hazard (Schanze, 2009). Overall, flood risk is a function of flood hazard, vulnerability and exposure (Schanze, 2006; Schanze & Hutter, 2006; Schanze, 2009; Franzi, 2010; Aven & Renn, 2010).

Flood risk system consists of source, pathways, receptors and consequences (Schanze, 2006, 2009). Schanze (2009) aptly applies the Source-Pathway-Receptor-Consequence-Concept (SPRC-Concept) to describe a flood risk system in a real world FRM. The source in the SPRC-Concept describes the origin of floodwaters (Schanze, 2006). Meteorological and hydrological events including precipitation and reservoir failure can spill water to cause inundation. Pathways are the attributes of a floodplain that influence occurrence and impacts of a flood event (Schanze, 2006). 'Source' and 'Pathway' together represent the origin and the chain of processes that generate a flood event. Receptors describe the societal values susceptible to flood hazard. A consequence of floods includes the harm to society, depending on the coping capacity (Schanze, 2009). Identifying sources, pathways, receptors and consequences, and their assessments are crucial steps towards understanding and managing flood risk (Amman *et al.,* 2006; Schanze, 2006, 2009; Samuels and Gould, 2009). Flood risk assessment provides a profile of areas prone to hazards, vulnerability, exposure and impacts of future floods. The assessment includes information on the type and magnitude of future floods and recommendations on risk management strategies. Future impacts of floods may include injuries, deaths and diseases, loss of possessions and livelihood, damage to physical infrastructure, psychological stress and social disorder (Samuels *et al*., 2009; Schanze, 2009).

Sometimes, the understanding and determination of flood risk do not address critical issues of unusual extreme flood events at certain periods of time and places. Uncertainties, covering epistemic and aleatory (inherent) uncertainties can distort determination of flood risk and management efforts of flood managers (e.g. Hall *et al.,* 2003; Aven & Renn, 2010). The epistemic uncertainty is a challenge to accurate estimation of flood risk. This uncertainty is due to human error in the calculation processes and misrepresentations of social perceptions, standards, decisions, and ambiguities about causes and potential impacts of floods (Aven & Renn, 2010). This

set of challenges can create a knowledge gap in estimating flood hazard, flood vulnerability, exposure and flood risk.

Errors in the calculation of flood risk are due to aleatory uncertainties (Aven and Renn, 2010). Aleatory uncertainties imply the errors inherent in the calculation of the probability of natural disaster events due to their random character and their possible long-term change. For instance, weather conditions and flood events can be predicted but their risk features and impacts are stochastic and impossible to accurately determine, thereby contributing to the uncertainty in flood occurrence and impacts (Diagne, 2007; Olorufemi, 2011). Moreover, possible long-term climate and societal change makes anticipation of the flood hazard, flood vulnerability, exposure and resulting risk unreliable for stakeholders (Comfort *et al*., 2010).

2.1.2 Expected and unexpected course of flood disasters

As pointed out in the previous sections, the causes and impacts of flood disasters can be anticipated through the process of risk analysis and assessment. This process can result in measures designed to reduce the determined flood risk (Boin and Schulman, 2008). Weick and Sutclifffe (2007) contrast expected and unexpected events in their discussion of "managing the unexpected" for resilience performance of high reliable organisations. They argue that "expectations are built into organisational roles, routines and strategies" that "create orderliness and predictability" in organisational risk management (*Ibid.*, 23). Weick and Sutcliffe (2007: 41) explain that, "when people form expectations, they assume that certain sequences of actions are likely to happen. These assumptions, which are embedded in routines, rules, norms, training, and roles, establish orderly guides for performance and interpretation. However, the same expectations that produce order and efficiency can also undermine reliable, resilient performance because they encourage confirmation seeking, reliance on existing categories, and simplification. Undermining instances result in unexpected and unimagined events that grow in complexity and can endanger operations the longer they remained unnoticed."

Expectation refers to "envision something, usually for a good reason, that is reasonably certain to come about. Expectations provide a significant infrastructure for everyday life. They are like a routine that suggests the probable course of events that trigger disasters'' (Weick & Sutcliffe, 2007: 25). Expected features of flood risk

are the determined features of flood hazard, vulnerability, exposure and impacts. These features constitute the expected course of flood disasters. The expected course of upcoming flood disasters describes “determined risk”, commonly described as probability or frequency respectively of flood events with their consequences. Methods of statistical calculations help to determine expected course of disasters. A determination of probable flood events with their consequences facilitates the design of measures and instruments of FRM. Calculation of probabilities of previous flood events with their consequences gives impression about their course. This impression becomes the basis for anticipating pattern of the future course of flood disasters and respective risk reduction activities. Usually, determined flood risk is described by referring to the expected features of the flood hazard and the vulnerability of flood-prone elements leading to a certain magnitude of social, economic and ecological impacts. Wildavsky (1991: 21) relates expected risk to imaginable hazards that, “only experience can tell us which among all imaginable hazards will in fact materialise and hence justify measures to reduce them.” Thus, the expected features of flood risk describe the facts of determined flood risk being estimated based on experiences with historic floods.

The approach to estimating determined flood risk does not include “undetermined” flood risk. Undetermined flood risk can be the underlying course of unexpected flood disasters. Weick & Sutcliffe (2007: 27-31) explain that unexpected is in contrast to expectations and argue that “unexpected events can have one of three forms. The first form of unexpected occurs when that which was expected to happen fails to occur. The second form of the unexpected occurs when an event that was not expected to happen does happen. The third form of the unexpected occurs when an event that was simply unthoughtful, happens.” In other words, unexpected events can be surprise features of an expected event or an entire event that have not been imagined in advance. The occurrence and impacts of these events had not been anticipated beforehand.

Wildavsky (1991: 21) describes unexpected risk as “irresolvable uncertainties” about future conditions and explains an “irresolvable uncertainty” as “one thing that no one can have for sure a guarantee that things will always be turned out all right in the future.” Comfort (1994: 174) also explains unexpected conditions in the organisational management of emergency risk using the Northridge Earthquake

event on 17th January 1994 as an example, indicating unexpected demands of “low probability, high consequence events.” In context of Business Continuity Management of the International Standards of Organisations (ISO 22301, 2012), unexpected is related to uncertainty and explained as “an effect of deviation from the expected” and “the state, even partial, of deficiency of information related to, understanding of or knowledge of, an event, its consequences or likelihood.” This explanation sees expected as opposite of unexpected as having partial or lack of certainties of the facts of a disaster risk.

In the context flood risk, an unexpected condition is situated in an unknown probability and uncertainty of the course of flood disasters because of e.g., changes in the conditions of rainfall pattern and societal development. Unexpected in probability can refer to a condition of no knowledge about the exact time and place of a flood event that occurs. Probability usually estimates the frequency of a flood event, but not the exact time of its occurrence. Unexpected can also be in a form of uncertainties when there is no knowledge about the exact course of a particular flood event with its impacts or its future change due to altering boundary conditions such as climate change and societal change. These changes can alter flood events with their determined characteristics. They can occur in determined scenarios and projections of flood events, calculation of probabilities of hazard and/or consequences, description of flood event type, magnitude and features with their social, economic and ecological consequences as Woods and Hollnagel (2006) posit. Hence, the unexpected needs special treatment in FRM.

In this study, unexpected course of flood disasters refers to an unknown course of a particular flood event with its consequences. The real pattern of a running flood event with its impacts can deviate from the anticipated flood risk. For instance, minor changes in unforeseeable course of a real flood event and the societal flood vulnerability and exposure can lead to a different kind and magnitude of consequences. A blockade of a drain or a culvert is a minor change but can be hard to detect during a flood event. This change can increase flood impacts beyond expected damage. Extreme flood events of unknown probability (e.g. 500 years events) with the resulting consequences could also lead to unexpected damage. Besides, expected can be a random or long-term change (“surprise”) of boundary

conditions for future flood events with the resulting consequences due to climate change or societal change (Wildavsky, 1991).

The unexpected course of flood disasters can originate from the inherent uncertainty and ambiguity that can render the response strategies of FRM irrelevant. For example, a real flood disaster is characterised by several uncertainties that make accurate anticipation of its course impossible. The real course of flood impacts may even be harder to determine as consequences of real flood events can happen randomly in defiance of the determined course. For instance, blockade of drains with debris and the resulting inundation of settlements may be the real course. Extreme flood events (e.g. a 500-year flood) are difficult to statistically calculate due to their rareness. Hence, a probability cannot be assigned to these events. Unexpected also refers to a long-term change that may not be anticipated yet. For instance, there could be a sudden future increase in the number of elements at risk and hence the demand for an unforeseeable response repertoire.

Flood event also comes with damages that can be context and flood event specific, with unexpected consequences. When rainstorm uproots trees, breaks down branches and built infrastructure in an event of flood, sudden damages to life and property could occur. Electrocutions, fire outbreaks and inundation of areas without a history to floods are few unexpected characteristics of a real flood event that are hard to anticipate.

2.1.3 Flood risk management

The International Business Continuity Management Standards of the International Standards of Organisations (ISO 22301, 2012) define risk management as "coordinated activities to direct and control an organisation with regard to risk." Organisational risk management involves several activities that need to be coordinated in the course of risk reduction. Similarly, the management of flood risk includes decision-making arrangements and processes towards prevention and reduction of flood risks. FRM also involves the processes and structures leading to interventions; measures and instruments for reducing flood hazards, vulnerabilities, exposure and impacts (Amman, 2006; Schanze, 2006). The judgement of the information, the evaluation of the management options and the decision on the final risk management option is prerogative of the FRM body (Aven & Renn, 2010: 121).

Schanze (2009: 7) describes FRM as a “holistic and continuous societal process of analysis, evaluation and reduction of flood risk.” Whilst ‘continuous’ connotes the ongoing condition of FRM as a societal process, ‘holistic’ implies that all possible factors within the flood risk system are considered in the management process. FRM is a societal process because it involves individuals, experts, opinion leaders, politicians and actors representing various sectors, institutions, organisations and locations with varied interests. These actors may have diverse interests and can influence decision-making and implementation of FRM strategies. These representatives take decisions about flood risk tolerability and any FRM interventions (Schanze, 2006). The focus of FRM strategies is therefore to reduce flood hazard vulnerability, exposure and risk.

Management also includes decision-making on the final FRM options. At a decision-making level, a management body that engages in analysis, evaluation and reduction of flood risk (Schanze, 2006, 2009; Gouldby *et al.*, 2009) carries out FRM. A flood risk analysis is based on expert and ordinary people´s knowledge about a flood event and impacts. The experts provide physical, technical and engineering information about the flood event. All background information before; during and after a flood event is useful for the risk management process (Schanze, 2009).

Evaluation and judgement of risk tolerability and reduction alternatives are a central part of FRM (Schanze, 2009: 7). In the evaluation and judgement of tolerability of risk, and risk reduction alternatives, some risks may be prioritised over others. In some contexts, for instance, protection of lives and assets from flood hazards can be a first priority (Amman, 2006: 9). Prioritisation can be necessary due to limited response resources and conflicting interests of stakeholders.

The tolerant risk level does not mean a total absent or complete acceptance of risk. Gould *et al*. (2009) explain that, flood risk levels range from high, medium, low to zero risk. Flood risk is weighed in order to take management decisions on risk levels that can be addressed and those that should not be attended to. FRM strategies may aim at reducing risk to levels of zero, tolerable levels or total acceptance of risk (Amman, 2006; Hutter, 2007; Gouldby *et al*. 2009; Franzi, 2010). The interventions can be strategic plans to accomplish a goal of FRM (Hutter, 2006, 2007). Target may include protection of lives, property, physical and social infrastructure, health and general social functions. Aven & Renn (2010: 137) contend that technical standards

and prescriptions, early warning systems as well as governmental economic incentives (taxation and subsidies) can limit exposure to risk in general. These measures can be appropriate for pre-flood event. Post-flood event measures are many and may include shelter, first aid and relief. Third-party incentives (private monetary and material incentives), compensation schemes are also feasible risk management options.

Before the paradigm of FRM, dealing with floods with reference to realist perspective on the view that flood is real, objective and can be prevented using flood hazard protection mechanisms (engineered structures). This notion incited construction of rigid engineered structures such as flood protection walls, impoundment dams, reservoirs, urban drainage system, and other measures for keeping flood hazards away from vulnerable elements (cf. Kundzewicz & Takeuchi, 1999). These flood hazard protection strategies apply ideas of engineers, policy makers, planners and socio-political elites. Spatial planning, settlement regulations, building codes, community development policies and maps are the prerogative of decision-makers, a classical top-down approach to water management. This management strategy concentrates on hazards, vulnerability, exposure and risk, which are crucial in FRM. Uncertainties and the complex nature of cities make the management of flood risks quite difficult.

A more comprehensive approach to dealing with flood risk is integrated FRM. This approach considers physical, social, economic and environmental vulnerabilities in the decision-making and planning. In this paradigm, risk management follows a multi-sectoral approach because there seems to be a problem that affects and involves all sectors of society. Here, the emphasis is not only on all organisations, but there are attempts to consider local communities in decision-making and implementation. Accordingly, community empowerment which contributes to "…building a risk consciousness…" for FRM as Kundzewicz & Takeuchi (1999: 425) put it, has become a core value of the bottom-up governance to the reduction of flood risk. Risk perception based on the culture, interest and knowledge of the local people and expert ideas are taken into account. The principles of the bottom-up approach such as stakeholder participation make the local community part of the management (ADPC, 2004: 8).

As Schanze (2009: 3) explains, “FRM deals with a wide array of issues ranging from the generation of hazard over its impacts to the preventive interventions for risk reduction.” The author further elaborates that “managing flood risks requires some systematisation of efforts to better understand the entire problem and to allow for a targeted development of supporting knowledge, methods and tools” for improving of FRM strategies (*Ibid*).

2.1.4 Flood risk management strategies

Strategies for managing flood risk are discussed in academic and professional cycles. Most often, the discussions focus on strategies for managing flood risk through structural and non-structural measures for preventing, protecting and controlling flood hazards, as well as mitigating exposure and vulnerability to flood hazards (Samuels & Gouldby, 2009; De Bruijn, 2010). These measures contain various alternatives for addressing risk from floods at pre-flood, flood event and post-flood risk reduction phases (Olfert & Schanze, 2007; Schanze, 2009: 7).

Traditionally, risk protection broadly involves the use of counter measures of engineering approaches to reduce flood hazards, while all actions for reducing exposure and vulnerability to floods without influence on dynamics of flood hazard is mitigation (cf. Franzi, 2010: 249). Mostly, emphasis is placed on reducing physical aspects of floods such as magnitude, velocity, extension of floods and decrease in vulnerability of receptors of floods. Construction works including dikes, channels, drains and water retention ponds and polders are examples of structural measures.

Franzi (2010) argues that flood insurance policies attempt to transfer and spread financial cost of flood impacts. Insurance policy can share the economic risk of floods between insurance companies and victims of floods (WMO, 2009). Flood insurance requires policy arrangements between insurers and organisations or individuals against future flood impacts.

Sometimes, non-structural measures may aim at coping with floods where it is impossible to get rid of risk that may remain after prevention, protection and mitigation measures. These measures may include issues of awareness of risk, plans for evacuation, collaboration with responsible agencies and general preparedness for dealing with determined flood impacts (Aven & Renn, 2010). Flood

risk reduction is an outcome of FRM, it is therefore important to be discussed as below.

Flood risk analysis yield maps for defining flood risk zones. Flood risk can be reduced by regulating developmental projects on flood prone areas. Dikes and sea defence walls aim at preventing submergence of land coastal areas. FRM regulations and policies encourage mitigation of flood risks. It is impossible to prevent floods completely from occurring. Accordingly, current FRM aims at flood risk reduction (see USACE, 2009; FEMA, 2015). FRM is similar to general disaster risk management, which Albala-Bertrand (2003: 79) defines "as a wide array of endogenous and exogenous reactions, measures, and policies that mitigate, counteract, and prevent disaster impacts and effects. Response to a disaster can be described as follows: once a disaster has occurred, the impacts stimulate the unfolding of systemic response mechanisms and the creation of specially designed response measures." Response to disaster risk therefore comes from internal and external sources through a system of responses, which could be specially designed to involve multiple sectors.

Other arguments suggest that flood risk affects all sectors of social and ecological systems, including economic, environmental and social systems and so is its management (Amman *et al*., 2006). Any risk that affects all sectors of society is described as systematic risk (Amman, 2006; Aven & Renn, 2010). Management of this kind of risk needs network of all actors, in a collaborative manner. Experts from non-governmental agencies, community groups, politicians and the private sector constituting FRM body make final decisions on management of flood risk. Conflict may arise when roles of the management organisations are not clearly defined and also when they have independent interests (Handmer & Dovers, 2007).

Strategy is a key concept in this research and needs to be explained. There is no common agreement on the meaning of strategy. In a generic sense, a strategy implies a combination of resources and measures for actions to achieve long-term goals of an organisation (Whipp, 2001 cited in Hutter, 2007). This understanding seems to limit strategy to anticipatory planning for long-term goals with limited options for dealing with unexpected disruptions in an organisation. A strategy is also referred to as "a consistent set of measures, aiming to influence developments in a specific way" (Hooijer, 2004: 346). This definition is similar in the realm of

anticipation planning but seems to be open and does not specify whether the influence on developments is long-term, short-term or both. A strategy for actions in FRM needs to consider possibilities for responding to unexpected disaster risk. In FRM research, Hutter (2007: 4) puts it in a daily life phenomenon and defines a strategy as "a statement indicating the direction of using structural and non-structural measures (e.g., do-nothing strategy, do-minimum strategy, use new measures to enhance FRM standard)." This definition gives room for short-term processes and interventions of FRM measures and instruments. Hutter (2007: 5) distinguishes this daily life understanding of strategy from a scientific viewpoint, and sees the strategy as multidimensional consisting of content, context and process dimensions as depicted in Figure 1

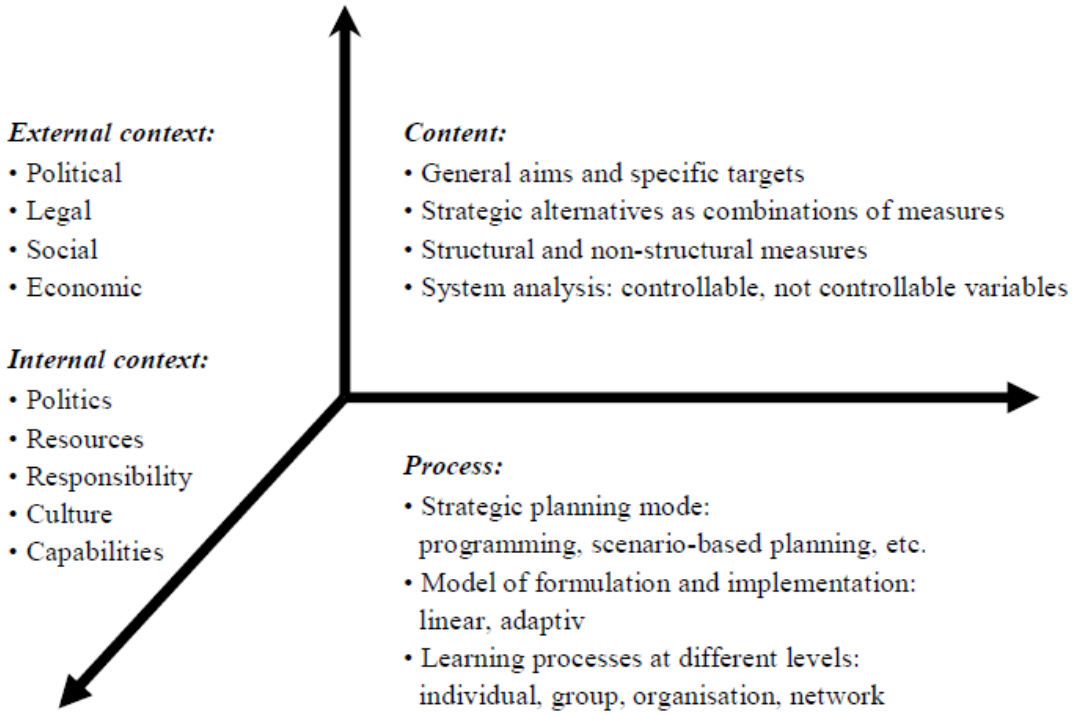

Figure 1: Context, content and process dimension of strategy

Source: Hutter (2007: 5; also see Hutter & Schanze, 2008).

A strategy generally covers issues of these three dimensions particularly for long-term planning of risk management. This understanding of strategy is comprehensive and useful for a generic framework as applied in this research. It addresses context (RQ1) as well as contents and process issues (RQ2). Nevertheless, these three dimensions influence one another. Resilience of FRM strategies is emphasised in

the management of flood risk in a general sense. The dimension of resilience is important because it holistically treats the unexpected course of flood disasters alongside anticipation, which addresses the expected features of flood risk. Resilience and anticipation attempt to capture the context, content and process dimensions of FRM strategies.

Sometimes, long term planning (Hutter & Schanze, 2008) involves continuous process of monitoring development of risks, learning from the past and adapting risk management to the course of disasters. It is important to acknowledge that master plans are long-term plans they are static and linear but not dynamic (flexible) to changes in future flood risks (Hutter, 2007; Fanzi, 2010). In this research, a strategy considers the ideas for these definitions and the arrangements and actions for dealing with unexpected course of flood disasters, which are often overlooked in anticipation planning for FRM.

The societal efforts to prevent, reduce, flood hazard and its consequences require resources from individuals and organisations. The literature in this research also suggests that FRM has representation of individuals and organisations with roles. Individual actors may represent various organisations in FRM. The concept of stakeholder theory in the Section 2.2.5 of this research explains individual organisations as stakeholders in FRM.

2.1.5 Stakeholders of flood risk management strategies

Stakeholders can be organisations or actors who are involved in organisational management (ISO 22301, 2012). Stakeholder theory is useful for identifying and explaining stakeholders in risk management, which can be good for stakeholder identification in FRM (Reed *et al*., 2009). Stakeholder theory provides conceptual lens and methodological tool to understand and identify stakeholders of FRM (Freeman, 1984; Miles & Preston, 1995, 2001; Futaki, 2010). The concept of stakeholder for strategic management is also traced to the seminal work of Freeman (1984). In a broad sense, Freeman (1984: 46) understands a stakeholder as “any group or individual who can affect or is affected by the achievement of the organisation’s objectives” (cited in Mitchell *et al.,* 1997: 854). The concept has since been widely used in various disciplines including, natural resource management and

policy development fields among others with various meanings and objectives (Donaldson & Preston, 1995; Reed *et al*., 2009).

In the words Fukati (2010: 1), sees a stakeholder as "anyone significantly affecting or affected by someone else's decision-making activity." Stakeholders as individuals are actors (persons) who hold "stakes" as principals or representative of institutions in FRM. Individuals or organisations influence management by virtue of the stakes they possess. Influence of a stakeholder can also be positive or negative depending on its output in management. Stakeholders from an inter-organisational viewpoint may also be individual organisations.

Stakeholders refer to organisations that affect FRM. Such organisations affect FRM through their stakes and attributes (e.g. legitimacy, roles, influence and urgency) (Fukati, 2010; Reed *et al*., 2009). In FRM, actors represent the respective organisations. Freeman uses stakeholder in business management context where individuals or groups as managers, board of directors, employees, shareholders, public, and institutions can influence or be influenced by the activities and objectives of an organisation operating a business or implementing a project. This stakeholder concept generally mixes individual staff as subordinate and managers at decision-making level as representatives of the organisations and does not differentiate between various stakeholders and their stakes. Freeman's definition is relevant for identifying broad stakeholders but less useful for categorising stakeholders using their attributes and interrelationship regarding decision making and implementation (Donaldson & Preston, 1995; Mitchell *et al*., 1997; Reed *et al*., 2009: 1933).

Definitions of the concept are usually normative and narrow. A stakeholder can refer to individuals or groups without whose support the organisation stops to exist or function (Bowie, 1991). As well, the concept more broadly includes non-living elements as any entity that occurs naturally and is affected by organisational performance (Reed *et al*., 2009: 1934). This definition has natural resource and environmental management background. It recognises the influence of interdependence not only among humans on organisational performance but also among the natural or non-living environmental aspects (e.g. natural hazards like floods) of organisational context. In public policy formulation and risk management, a wide range of stakeholders including policy makers, local communities, local and national organisations, international agencies, non-governmental organisations and

corporate sectors may influence or be influenced (Friedman & Miles, 2002; Reed *et al*., 2009).

Stakeholder can imply a legitimate organisation with members who have a mandate in management. Legitimacy of stakeholders is context specific and therefore difficult to have a conventional interpretation (Schuman, 1995). However, scholars from the field of business management argue that stockholders are legitimate stakeholders because they own stocks of business and distinguish that stock managers need not be seen as such because they only manage stocks for profits of stockholders (Mitchell *et al*., 1997). In FRM, stockholders are the public and individuals whose safety from flood impact is the responsibility of the key stakeholders. Other academics insist that managers as well as stockholders are stakeholders whilst some researchers in the policy and natural resource management argue that a legitimate stakeholder has legal rights and recognition to influence policy and risk management (Mitchell *et al*., 1997; Reed *et al*., 2009). The right to execute definite roles and resulting responsibilities is legally binding. Recognition indicates the social recognition of such organisations and representatives. Friedman & Miles (2006) agree to the view of other scholars that, there is need to determine legitimacy of stakeholders in the stakeholder analysis but insist that determining the difference between legitimate and illegitimate stakeholders is fundamental for defining the influence of stakeholders over organisational management activities. Drawing a line between legitimate and illegitimate stakeholders can contribute to gathering information and resources for strategic management (Reed *et al*., 2009).

Stakeholders of public management can be the organisations or their representatives who have the mandate (power) to manage societal issues (Mitchell *et al*., 1997). However, the concept of power is contested and uneasy to recognise except when it is exercised. It can be applied in stakeholder analysis as “a relationship among social actors in which one social actor, A, can get another social actor, B, to do something that B would not otherwise have done” (Pfeffer, 1981: 3 cited in Mitchell *et al*., 1997: 865). The relationship between actors A and B can refer to the influence they have on each other and a potential alliance between them in organisational management. This understanding of power seems to refer the authority, influence and urgency that stakeholders possess to affect management as actors or representatives of organisations.

Power as an attribute of a stakeholder is argued to exist in different forms. For instance, Mitchell *et al*. (1997: 865) categorise power as coercive, symbolic and material resource forms of power. Coercive power is exercised through force to influence other stakeholders. Symbolic power also known as normative power is exercised by means of symbolic resources that are not based on force or physical threat but through acceptance based on normative (social) symbols a stakeholder possesses. Stakeholders with specific roles may have social symbols that distinguish them from other stakeholders. Material or utilitarian power is exercised through material or financial resource to influence other stakeholders on decision-making and implementation. Frooman (1999: 195-196) explains how critical resources are in stakeholder relations of power, especially for resource dependent stakeholders. Resources may include human, technical, financial, logistics, information and legal power to act. Frooman (1999: 196) acknowledges power not only as an individual stakeholder attribute but also as an attribute of interrelationship of two or more stakeholders. Power can also be mobilised through an alliance of weak stakeholders who can jointly affect FRM.

Literature further suggests that urgency is a crucial factor in the mapping of stakeholders. Urgency relates to time-sensitivity and criticality or importance of a stakeholder functions or role (Mitchell *et al*., 1997: 867). It is time sensitive in that a managerial delay in attending to the roles or responsibilities in the relationship of the actors can be disastrous and unacceptable. The importance of the role a stakeholder plays influences the level of attention and status of that stakeholder in an organisational management. Mitchell *et al*. (1997) specify stakeholder salience using three main attributes where legitimacy and urgency as well as power were included. In their analysis, power is seen in the influence other stakeholders in management. These researchers chose those attributes based upon their research focus and objectives. In their analysis, Mitchell *et al*. (1997) note that a stakeholder who has two or three of the attributes is a salient stakeholder in management. While a stakeholder with three is self-justifiable, a salient stakeholder with two of the attributes may be a normative stakeholder. This analysis presupposes that a stakeholder with two of the attributes can be potential key stakeholders and may even form coalition with others to influence management.

In this research, the four attributes of legitimacy, roles, influence and urgency for the selection of key stakeholder in FRM. The choice of all the four is ensure convenience and a common standard as well as lack of confusion in the selection criteria. This choice the attributes for the selection seem normative but falls in line with the norms of stakeholder analysis (Mitchell *et al*., 1997; Reed *et al*., 2009)

Donaldson & Preston (1995) articulate their concerns about the confusion around the nature and purpose of stakeholder theory and make effort to set a straight line by distinguishing clearly among descriptive, instrumental and normative aspects of stakeholder theory. The descriptive aspect of stakeholder explains the characteristics, nature and activities of stakeholders, and it is justified by "the existing practices and institutions", referring to lawful mandates to formulate and implement policies (Donaldson & Preston, 1995: 69).

Stakeholder theory is widely applied in research to describe organisations with their representatives, roles, operational standards, and influence in management strategy. Stakeholder theory applied from instrumental point of view explains the linkage between organisations and their objectives (Mitchell *et al*., 1997; Donaldson and Preston 1999: 70; Friedman & Miles, 2002). Stakeholders, from this viewpoint, refer to traditional operational principles and objectives. Reed *et al*. (2009: 1936) concede that stakeholders described based on their operational principles and objectives of management are more pragmatic and focused on understanding what and how organisations with their actors achieve desired objectives. The attention is on explaining the roles and management strategies of the stakeholders. Instrumental stakeholder theory assesses the performance of stakeholder regarding their principal roles. This is a descriptive aspect of the theory. The instrumentality view of stakeholders is appropriate for analysis of legitimacy, roles, influence and urgency, of multiple stakeholders (Freeman, 1984; Frooman, 1999; Friedman & Miles, 2002; Reed *et al*., 2009).

However, Donaldson and Preston (1995: 86-87) argue that "stakeholder theory is fundamentally normative" since the instrumental case for stakeholder management cannot be satisfactory and the fact that stakeholder theory goes beyond descriptive observation of organisation's stakes to include managerial implications. Stakeholder operations and roles can be guided by norms, values within the organisation and external. These norms can be formal or informal. This brings up the issue of core

moral values and philosophies that underlie the functions of an organisation in a specific management strategy (Donaldson & Preston, 1995: 71). Normative basis of stakeholder analysis explains the social responsibility of public organisations. Public organisations directly or indirectly have contractual relations with individuals or organisations where they operate. The above explanations show the concept of stakeholder theory broadly describes legal (instrumental) and normative characteristics of organisations with their actors and specifying their various legitimacy, roles, influence and urgency. Similarly, Reed *et al*. (2009) note that normative basis of stakeholder analysis may lead to instrumental outcomes. These outcomes can influence organisational characteristics and existing norms of inter-organisational relationships. Beyond, Friedman (2002) argues that the descriptive view of stakeholder theory is useful for improving risk management strategies (see also Grimble, 1998; Friedman & Miles, 2002; Reed *et al*., 2009; Futaki, 2010; Sempijja, 2013).

The concept of stakeholder is generic and does not differentiate managers as key stakeholders from individuals in organisations who play roles of ordinary staff. However, in organisational management of risk, managers perform management roles, which are different from everyday activities or tasks of personnel as individual stakeholders below the management position. Thus, focus on key stakeholders in organisational risk management brings this difference into the discussion of the stakeholder concept. The concept of key stakeholder appears new in the stakeholder theory. This looks important because management strategies, the value of key stakeholders who represent management organisations in board meetings and committees cannot be underestimated. This then requires a framework that specifies indicators for defining key stakeholders of a specific project in public realm (see section 3.4.1). Actors of organisations in FRM may play specific roles defined by legal regulations, referred to in this research as legitimacy. In certain situations, a stakeholder becomes key due to the attributes of legitimacy, roles, influence and urgency in risk management. Management also includes decision-making and its implementation.

Stakeholder theory is basis for stakeholder analysis. In this research, stakeholder analysis considers a systematic gathering and interpretation (analysis) of information on actors in order to determine whose legitimacy, role, influence and urgency count

in FRM. The next section discusses conceptual views on risk governance that incorporate FRM strategies.

2.1.6 Risk governance beyond flood risk management strategies

Dealing effectively with risk issues may have to involve institutional arrangements and networks of all stakeholders in the risk management (cf. IRGC, 2005). This is where the concept of governance is relevant for managing systemic risk issue and also the fact that management is an operational issue and is therefore embedded in a more comprehensive governance regime. IRGC (2005: 22) explains that governance describes the structures and processes for collective decision making involving governmental and non-governmental actors. The actors include governmental institutions, economic actors, organisations and civil society at local, community, national, regional and global levels (Aven & Renn, 2010). Governance includes a totality of actors, roles, conventions, processes, and mechanisms related to how relevant risk information is collected, analysed and communicated as well as the manner in which management decisions are taken and implemented (Aven & Renn, 2010). This requires collaboration and coordination between stakeholders. Collaboration and coordination enhance stakeholder involvement and transparency in decision-making (Amman, 2006). Actors (technical scientific experts, laypersons, politicians, corporate sector, and civil society) in risk governance benefit from their existing networks (social capital) where sharing of knowledge and information contribute to address risk issues (Amman, 2006). Structures include economic, social, political, cultural and scientific/technical policies and mechanisms that influence risk management (IRGC, 2005).

The core values and substance of governance concept are translated into risk related decision-making (IRGC, 2005). Amman *et al*. (2006: 6) explain that, risk governance pertains to how a holistic decision making unfolds when a myriad of stakeholders (actors) are involved, demanding coordination and potential reconciliation between several roles, perspectives and activities. Holistic coordination is essential because risk challenges usually outweigh the problem-solving capacity of a single authority and need structured networks of all stakeholders (Schanze & Hutter, 2008).

Risk governance is concerned with structural arrangement to coordinate risk management. Governance considers contextual institutional arrangements and legal framework that determine relationships, roles and responsibilities of actors. This means that flood risk governance accounts for institutional regulations and legal framework that determine the roles and responsibilities of the actors and co-ordination mechanisms such as markets, incentives or self-imposed norms as well as context of the political culture (varied perceptions) of risk management (IRGC, 2005). Organisational agreements exist for specific roles and responsibilities of each of the actors in water risk-related management process (Handmer & Dovers, 2007). These arrangements facilitate distribution and coordination of roles as well as coordination of activities, perspectives, goals and interests of actors (Reed *et al.*, 2010). Actors may have different interests and perspectives about risk management and coordination of activities could reconcile such differences.

Aven & Renn (2010) also explain that governance consists of vertical and horizontal relations. Vertical relations describe the top-down linkages between stakeholders of high and low level order authorities. For instance, political power differences among international, regional, national, district and local community stakeholders may produce vertical risk governance relationships Risk governance also involves networks of actors between these geographical levels and their functional structures. Horizontal aspect of risk governance is the link between the structures at each of the local, community, regional, national and international arenas (IRGC, 2005; Amman, 2006). Risk governance considers networks of the governance structures and actors to collectively manage flood risks. These structures have different capacities and specific roles to play in risk governance. Local community individuals, groups and institutions may connect to external players to pull resources for risk management. The horizontal networks in risk governance suggest the linkage of actors within a determined geographical area.

The potential advantage of having defined risk governance structures and processes for risk reduction is that, they prepare a solid foundation for resource mobilisation and distribution. This can support risk managers to share knowledge and understand the overall management capacity for future risk management (Hutter & Schanze, 2008). Where the risk management structures and process are not clear, coordination and collaboration of stakeholders can be difficult.

One characteristic of risk governance, involved in risk management strategies, is bureaucracy (O'Brien *et al*., 2006). There can be a delay in engaging all organisations the management of floods (Hayden *et al*., 2003). The delay due to bureaucracy helps in the formulation and implementation of FRM in long-term but it usually involves processes of crosschecking and hierarchical institutional approvals, which stall emergency responses leading to escalating disasters. There can be a delay in the response to flood risk if the structures and process in FRM policies are unspecified.

The coexistence of multiple organisations is a key character in risk governance in terms of policy design and implementation (Renn & Aven, 2010). Moreover, disparities in risk perceptions also compound uncertainties in traditional FRM strategies. For a collective public interest in FRM, organisations and individuals with varied but related roles and priorities in risk reduction might co-exist in FRM. Coexistence is considered in the use of resources from public, private, organisations and individuals for risk governance (Birkman, 2006). UNISDR (2005) proposes in the Hyogo Framework for Action the need to use international, national, and local resources for disaster risk reduction. Considering these disparities in decision for risk reduction can enhance effective policy implementation (Samuels *et al*., 2009; Aven & Renn, 2010).

The practice of decentralisation is believed as an asset in risk governance. Decentralisation is seen in the administrative, political, and economic aspects of risk governance. Administrative component relates to the transfer of authority from national to the regional and local government organisations to make and implement policies. Political component is about decentralising political power to influence policymaking and implementation at the local district levels. Decentralisation of FRM resources is concerned with the making funds readily available to local organisations for policy-making and implementation (also see Birkman, 2006).

Aven & Renn (2010) argue that risk governance plays a role in how stakeholders communicate in FRM. Governance is about the institutions, roles and regulations in management. Regulation and effective means of communicating flood risk information can bridge any tensions between the public and expert judgement about risk (GIZ, 2011). Flood risk communication encompasses educating and informing stakeholders about flood risk and how to respond to it (UNISDR, 2005, 2009; The

World Bank, 2009, 2012). Effective communication of risk can induce behavioural change to cope with flood risk as well as to promote confidence in institutions responsible for managing flood risk. For instance, early flood risk warning systems is a form of communication that can reduce consequences of floods. Flood risk communication can facilitate stakeholder participation in risk-related decision-making and can resolve inter-stakeholder conflict by incorporating stakeholders in the risk-related decision-making process (cf. Comfort *et al*., 2010). Communication may involve print and electronic media, workshops, stakeholder meetings, inter-personal communication and the use of modern and traditional ways of information dissemination.

Network of organisations is a major element in risk governance as it has the capacity to enhance trust and accountability (IRGC, 2005; Aven & Renn, 2010). Network can be formal and informal interrelation among organisations and individuals influenced by risk governance. Financial and technical resources, as well as social networks are also important for risk governance (Hutter & Schanze, 2008; Hutter 2010). Since flood risk governance is a process encompassing institutions and human actors who engage in research, decision-making and policy implementation for FRM, it is imperative to emphasise that social capital needs to be strengthened among stakeholders throughout the management and operational processes. If social capital is fortified, it can promote information distribution and knowledge sharing among the actors. Network can be in tight or loose relations among organisations. Pike *et al.* (2010: 64) contend that "loose couplings directly and indirectly connecting social agents are considered crucial for modifiability of networks because they allow elements to adapt and modify in response to contingency without disrupting the whole system, offer wider bases of local knowledge and accommodate more novelty and mutation."

2.2 Resilience in flood risk management strategies

The concept of resilience has not been widely researched in the context of disaster risk management and particularly in the area of FRM (UNISDR, 2005; Comfort *et al*., 2010; World Bank, 2012). The concept however, has a potential of transferring its positive outcomes to the field of disaster risk management in general and FRM in particular. The relation between FRM and resilience is linked to the issues of unforeseen courses of disasters during flood events. FRM focuses on addressing

determined risks from floods, which can disrupt societal functions. Some impacts of floods can occur during a running flood event without prior anticipation. The point for resilience is to ensure an ability to cope with, and respond to such unexpected disturbances in the face of a flood event. The concept of resilience deals with undetermined impacts during a flood event whereas FRM strategies from anticipatory planning respond to determined impacts of a flood event (Gallopin, 2006).

FRM involves analysis, assessment and reduction of risk. The reduction of flood risk makes use of instruments and measures. These measures and instruments mean to prevent and reduce flood hazards and mitigate vulnerability and exposure to floods in the sphere of anticipation. However, these instruments and measures may be helpless to unexpected course of flood risk and impacts. Resilience concept which is concerned with the capacity for dealing unexpected situations may improve response capacity of FRM strategies to cope with unexpected course of flood disasters (Klijn and De Bruijn, 2003; De Bruijn *et al*., 2010). The value is resilience in FRM strategies is to add a capacity that will allow key stakeholders to deal with unexpected flood risk after they have become manifest (Wildavsky, 1991). Resilience in FRM strategies also require addressing issues of anticipation to prevent, protect and mitigate expected flood risks and impacts. Notably, designing flood risk measures beyond the determined flood risks and alternatives to cope with excess volume of floodwaters can be useful (De Bruijn &d Klijn, 2001; De Bruijn, 2004; Wardekker *et al*., 2010). From a descriptive line, the characteristics of resilience are being argued as the features and practices of organisational flexibility, persistence, resource mobilisation, capacity building, information process and availability, participatory governance, diversity, among others, in the face of disaster risk (Wildavsky, 1991; McManus, 2007; Bruijne *et al*., 2010). FRM involves organisations and public through a wide range of practices involving analysis, assessment and reduction flood risk. The application of resilience in FRM strategies can be useful in response to unexpected course of flood risk. The next section focuses on the conceptual overviews of resilience.

2.2.1 Overview of resilience concepts

A common meaning and application of resilience do not exist in scientific community yet (Brand & Jax, 2007; Comfort *et al*., 2010). Researchers in different fields apply

diverse meanings to the concept (Brand & Jax, 2007; White, 2010; Welsh, 2012; Liao, 2014). In management research, resilience describes a system's characteristics of stable state during disturbances, and process of reaction to recover from shocks (De Bruijn, 2004; McManus, 2007). For instance, an organisation that is able to return from a state of bankruptcy and re-operates normally can be seen as resilient. In the context of engineering resilience, Wreathall (2006: 275) gives an initial view on properties of resilience organisations and defines the concept as "the ability of an organisation (system) to keep, or recover quickly to, a stable state, allowing it to continue operations during and after a major mishap or in the presence of continuous significant stresses." This definition seems to consider resilience as relevant to mega disastrous events to the neglect of minor unexpected changes in risk that can also cause disasters.

One can compare resilience with anticipation in risk management. Resilience in contrast to anticipation (resistance) is argued by Wildavsky (1991: 77-85) as a preferable strategy for risk management of real disastrous events (e.g. floods) with low probability and uncertainties. Contrarily, anticipation is applied for resistance to specific and known risk with substantial certainty and high probability of occurrence. In risk management, anticipation is superior to resilience under conditions in which risk managers - know what, know when, know how much, and act as indicated (Wildavsky, 1991). However, this is hardly realistic disaster events, especially flooding, where unexpected occurrences come along with expected risk. Both anticipation and resilience in FRM strategies can be useful to deal with predicted and unpredicted flood risk and impacts respectively. Organisations responsible for dealing with disasters can therefore put mechanisms to prevent disasters and other mechanisms to cope or live with disaster risks after a disastrous event has occurred (Wildavsky, 1991). These are resistance and resilience strategies respectively. The operational dimension of the resilience concept describes the state and features handling disturbances from disaster (De Bruijn, 2004).

Application of resilience in disaster risk management is still in an early stage and therefore has no established theory and application in research (Bruijn, 2004; Brand & Jax, 2007; MacAskill & Guthrie, 2014; Aldunce *et al.*, 2015). However, through descriptive and normative perspectives, several scholars in the fields of engineering, ecology, management and social science have defined resilience and proposed

characteristics describing resilience of a system. For the purpose of this research, the background of the resilience concept and its application in organisational disaster risk management strategies is emphasised.

The concept of resilience was initially used in engineering and ecological science to describe stable states of systems (Holling, 1973). When stable system experiences disturbance, it returns to its original stable state of conditions without changes in the system's structure and functions after the disturbances (Holling, 1973, 1996). This definition of resilience is relevant for closed and single equilibrium systems where external influence is minimal or shielded. This does not exist in ecological and social systems where there is no single equilibrium state (Holling, 1996). Ecological dynamic environment with multiple equilibriums, persistence is more applicable instead of resistance. In this context, a resilience system may find more stable state equilibriums after disturbances (Holling and Gunderson, 2002). Therefore, Holling (1973: 14) originally defines resilience as a "measure of the persistence of systems and their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables" (also cited in Holling 1996; Brand and Jax, 2007).

The original understanding of resilience was applied in ecological science for the management of ecosystems and environmental resources. However, in an advanced conception, resilience is understood as the capacity of a system to experience shocks while retaining essentially the same function, structure, feedbacks, and identity (Walker *et al*., 2006: 2). Resilience of a system can be associated with the capacity of a system to cope with shocks or disturbances, bounce back and maintain its functions after experiencing shocks and to return to a stable equilibrium after disruptions (Holling, 1996; De Bruijn, 2004; Brand & Jax, 2007; Wardekker *et al.*, 2010; Hutter, 2011).

In the fields of social science, the concept of resilience has neither a common meaning nor application. For instance, Adger (2000: 347) understands resilience broadly as the "ability of groups or communities to cope with external stresses and disturbances as a result of social, political, and environmental change". Resilience in this understanding focuses on responding to any disturbances due to socio-political and environmental disruption. From economic point of view, Perrings (2006: 418) explains resilience as the ability of the system to withstand either market or

environmental shocks without losing the capacity to allocate resources efficiently. Developing world cities have been facing social, political and environmental changes through the high rate of urbanisation and its related environmental management problems. In the context of flood risk, Okyere *et al*. (2013) explain that social, political and economic factors affect risk of flood impacts among poor communities in Accra. Economic forces influence the amount and distribution of flood response resources for the management of flood risks. Other scholars also see resilience as in characteristics of policies to adapt to changes in risk and disturbances (Perrings, 2006: 422-423).

One characteristic of resilience is the awareness of managers to risk management environment of an organisation (McManus *et al.*, 2007). Awareness refers to the knowledge and information about the organisational environment and risk management (McManus *et al.*, 2007; Stephenson *et al*., 2011). Organisations need to be aware of the risks that confront them in order to take informed decisions and implement appropriate risk management strategies. Awareness of risk goes beyond having exact information and details of determined risks to include mindfulness of uncertainties of undetermined risks, which may lead to unexpected course of disasters. FRM uncertainties are unavoidable due to the unpredictable nature of flood events, and lack of solid knowledge for reduction of risk (Renn & Aven, 2010; Apel *et al.*, 2004: 295). Structural failures can also be highly uncertain.

The literature further interprets resilience as the persistence and continues functioning of institutions, policies, regulations, norms and structures that influence risk management and human behaviours in the face of disasters (Handmer & Dovers, 2007; Resilience Alliance, 2010: 8; Lang, 2011). Institutions regulate behaviour and attitudes of individuals, groups and organisation towards risk reduction. Attitudes of individuals, organisations and communities constitute vulnerability to flood hazards and sometimes have to be regulated to reduce exposure to flood risk. Institutions may have constitutional regulations or normal practices for influencing social processes (Handmer & Dovers, 2007). There are formal or informal institutions. The point is that decision-making and implementation may include all stakeholders rather than limiting decision making to only a few stakeholders in the system (Lang, 2011: 18). This assertion suggests that the determination hinges on the ability for self-organisation to cope with change.

Stakeholder participation and general flexibility in decisions are highlighted for possible ways of balancing power, promoting self-organisation, and continuous learning to deal with changes in disaster risk (Resilience Alliance, 2010).

Scholars also interpret resilience as an approach to achieve sustainable development (Obrist *et al*., 2010; see also Brundtland Report, 1984). Risk of disasters generally affects social, economic and environmental wellbeing, and considers as distracting the achievement of sustainable development (UNISDR, 2005, 2015). However, whereas sustainability is generally measured by social, economic, and environmental indicators, conventional indicators for measuring resilience are not yet defined (Gallopin, 2006; Brand & Jax, 2007).

The concept of resilience is described in terms of response capacity, coping capacity or adaptive capacity of a system to disruptions (Adger, 2006; Gallopin, 2006: 296). The concept can apply to both short and long-term responses to risk (Smith & Wandel, 2006). Specifying resilience in FRM strategies has a potential to facilitate analysis of the response capacity of the main players in FRM. The response capacity of the key actors of FRM helps to describe the resilience of a system since both terms have a rather similar meaning. A response capacity of a management system also reflects its adaptive capacity, which refers to the adaptability of an organism, group of organisms, community or system to changes in an ecosystem. Adaptive capacity measures the response capacity of a community to environmental changes. Response capacity reflects adaptive capacity since it applies to the same meaning in this research. Nelson *et al*. (2007: 397) define adaptation as "the decision-making process and the set of actions undertaken to maintain the capacity to deal with future change or perturbations to social ecological systems without undergoing significant changes in function, structural identity, or feedbacks of that system while maintaining the option to develop." It is important to acknowledge that the concept of resilience applies in this research is not the same as adaptation. Whereas resilience includes the capacity to deal with disturbances during emergency disaster risk management, adaptation is more of anticipation focusing on dealing with long-term changes in disaster risks.

Response capacity encapsulates social, economic and physical survival (livelihood) of resources for coping disaster risk. Structural and non-structured measures for coping with disturbances to physical, socioeconomic and environmental values are

risk management resources (Kendra & Wachtendorf, 2003). These measures, especially the structural measures (engineered structures) and risk management policies (land-use regulations), can be seen as more of adaptation than in the sense of resilience. Resilience mechanisms include emergency evacuation, relief aid, insurance policy, engineered structures, early warning system, education, and action plans. These activities are actions that target to reduce the hazards, vulnerability and exposure as well as the probability of occurrence and consequences of flooding.

Brand & Jax (2007) conceive resilience as a ´boundary object´ and this can have negative and positive implications on applying the concept in research and practice in a real world. On one hand, the lack for theoretical basis can be a disadvantage because no conventional definition can be assigned to it. On the other hand, a lack of theoretical basis makes resilience versatile and adaptable for use in various disciplines. Brand & Jax (2007) therefore concludes that the concept of resilience is therefore arbitrary and hard to achieve. However, they argue that, to cope with the 'boundary object' attribute of the concept, requires that separate definitions ´be assigned to resilience for application in social ecological systems, ecological systems and ´boundary object´ perspective.

Contrarily, Hutter (2011) contends that the resilience concept does not need a precise definition especially when dealing with uncertainties such as natural disasters, and recommends that operational definition can be identified at the outset of events. The reviews indicate different perspectives about whether there is need for precise definition of resilience or not. However, a precise definition of the concept can be undoubtedly useful for scientific work. From these arguments on resilience, this research follows the view that, attempts to determine a conventional definition for the application of resilience is important because it has a potential to promote research and theory development. This understanding is also informed by the fact that resilience concept is still at its development stages, both in theory and application. Subsequently, there is more room for research to contribute to the theoretical development of the concept as the work of Schmidt (2011) further advocates.

The concept of resilience in the humanities is applied in organisational policy and management research. Here, the term describes the characteristics of management structures and process that can enable organisations to survive crisis (Kendra &

Wachtendorf, 2003; Stephenson *et al*., 2010, Rouse, 2012). Wildavsky (1991) argues in this regard for combination of strategies of anticipation and resilience in response to risk and impacts of disasters. These principles are relevant to disaster management although their operationalisation is a major challenge.

The work of Wardekker *et al*. (2010) attempts at operationalising the concept of resilience using a set of principles of resilience similar to those proposed by Wildavsky (1991) to assess the resilience of the climate change risk management policies in the city of Rotterdam, The Netherlands. This work suggests that resilience of policies to climate change risk can improve by incorporating preparedness, foresight planning and compartmentalisation. This argument is similar to the thoughts of De Bruijn (2003) from an architectural background, which supports compartmentalisation and foresight as resilience strategies to reduction of flood risk. What is common to the two works is that they focus on FRM in a river basin in a developed world context. However, a similar work in a developing world context is yet to be done. Comfort (1994) also applied some of the principles proposed by Wildavsky (1991). The works of McManus *et al.* (2010), Stephenson *et al*. (2010) and Rouse (2012) also highlight the key features of organisational resilience in disaster risks management. These works flagged out issues about awareness of hazards and vulnerabilities, response capacity and uncertainties of future disasters. These characteristics reflect in the five priorities of Hyogo Framework for Action (HFA 2005-2015).

The review of the concept of resilience in this section is useful for operationalisation of resilience in FRM strategies in this research. The next section discusses the connection between resilience and in FRM.

2.2.2 Resilience and flood risk management

The link between resilience and FRM is discussed in this section. FRM is a framework consisting series of activities of analysis, assessment and reduction of flood risk. Resilience is a contemporary approach through which society organises and reflects on management of flood risks (Warner, 2011). Resilience, in this context, has a potential to bring innovation and improvement to FRM strategies and making societies capable of coping with flood risk and impacts.

Integrated FRM paradigm is based on the grounds that, flood affects several sectors of society and the approach to prevent flood disasters does not seem to work well. Thus, there is a need to look at the sectoral component of FRM to allow all sectors to be integrated in the management process (Cardona, 2003). Integrated FRM refers to the contributions of various sectors in the management of flood risk. Flood risk may also exhibit extreme and unforeseen conditions that can lead to flood disasters. This could be unknown return periods of flood events, as well as the time and physical conditions of flood events. Unforeseen conditions make events rapidly dynamic and complex to address. Resilience has the potential to account for these values in FRM (Vincent, 2007; UNISDR, 2005, 2009).

The current discussions about FRM focus on resilience of cities to flood risk (Resilience Alliance, 2010, UN-Habitat, 2009). However, networking among organisations and coordination of resources to build capacities to respond to flood disasters is lacking (UNISDR, 2009; The World Bank, 2012). Resilience can provide opportunity to enhance the capacities of FRM actors to respond to uncertainties of floods in urban areas. Uncertainties cause the unexpected course of flood disasters. The unexpected course of disasters for instance incorporates the exact time of flooding, blockade of culverts, and requirements for aid to the flood victims. The response is a function of the degree of stakeholders' preparedness regarding early warning, evacuation, delivery of relief items and recovery from flood impacts. The application of resilience in FRM addresses the capacities of responsible actors to respond to these uncertainties in an effective way.

In this research, resilience is understood as the capacity of key stakeholders of FRM to respond to the unexpected course of flood disasters, besides their capacity to reduce the anticipated flood risk (Wildavsky, 1991). This research deals with multiple organisations of FRM in the public sphere, and therefore, focuses on the aspects of resilience in the management strategies of multiple organisations.

For instance, Hutter (2011) notes that research on natural disaster management, especially FRM, can apply to organisational resilience perspective in the context of social resilience (Folke, 2006). The capacity of stakeholders in FRM strategies to respond to unexpected and expected features of flood risk is applied here as one aspect of social resilience. The research is not however, a comprehensive assessment of social resilience of FRM. It only accentuates one component of social

resilience to understand and analyse the capacity of key stakeholders in FRM strategies to respond to the unexpected course of flood disasters aside to the expected flood risks.

This notion of resilience is in line with a principal debate on the strengths and weaknesses of anticipatory planning for risk reduction in management and disaster risk studies. Resilience of public action to a running disaster is contrary to planning for a risk in anticipation. As Wildavsky (1991: 77) explains, anticipation is "a mode of control by a central mind efforts made to predict and prevent potential dangers before damage is done" whilst resilience is "the capacity to cope with unanticipated dangers after they have become manifest...." This research considers both resilience and anticipation as major domains of FRM strategies in respond to both expected risk and unexpected course of running disasters. Traditional FRM involves high uncertainties in the treatment of flood risk because it is based on anticipation, which does not account for unpredicted courses of flood disasters. Beyond anticipation, resilience considers the preparedness and the resulting capacities in dealing with the unexpected courses of flood disasters. Thus, resilience may reduce failure rates in responses to the flood issues in general (cf. Wildavsky, 1991). Strategies based on anticipation focus on dealing with flood hazards, vulnerabilities and exposure in FRM in a long-term perspective. These are also major factors in the analysis, evaluation and reduction of flood risks (Schanze, 2006). Strategy of resilience can go beyond addressing expected flood hazards, vulnerability and exposure to consider possibilities to respond to risks from contingencies of floods. Some contingencies of flood disasters can be unexpected and may occur during flood events and need a redress from the point of resilience in FRM (De Bruijn, 2004).

Resilience also describes the availability of response resources of risk management organisations as a capacity to deal with disaster risks in general (Armitage and Plummer, 2010). Capacity of organisations may come from internal and external resource-base. Accordingly, Lebel *et al*. (2006) note that organisations can enhance their response capacity through inclusive participation of stakeholders in disaster risk management decision making and implementation. Kendra & Wachtendorf (2004) and Comfort (1994) contend that effective cooperation of stakeholders contributes to the resource-based response and mobilisation for dealing with emergencies and uncertainties of disasters.

The discussion on resilience further considers the sharing of knowledge and information among stakeholders for FRM. Mens *et al.* (2011) describe the resilience concept as positive results of stakeholder cooperation regarding resources mobilisation (e.g. information sharing, response resources for dealing with emergency flood events) and distribution in disaster risk management may advance the response capacity of the key stakeholders to unexpected floods. Deliberation determines the administrative structures and controls in response to flood risk, as this determines how prepared are stakeholders to respond to floods. Preparedness also counts for the legitimacy, roles, influence and urgency in the deliberation. A strategy of FRM may target to broaden or reduce the administrative structures and controls to capture a certain number of stakeholders. Internal and external sources of information and data can be harnessed for relief response through cooperation networks among stakeholders. Making use of additional resources from external sources can increase stakeholder capacity in response to unexpected course of disasters during flood events.

Coordination among organisations in mobilising resources can enhance their response capacities to cope with unexpected course of flood disasters (Lebel *et al*., 2006; Manuta *et al*., 2006). Similarly, Manuta *et al.* (2006) have more discussion on the institutionalised incapacities and practice in FRM in Thailand and stress coordination as key factor. Their research found out that coordination across the FRM administrative bodies was poor, causing delays in their performance. They conclude that, “coordination across administrative hierarchies is very important in the timely delivery of service and support before, during and after the crisis” (Manuta *et al*., 2006: 21). Coordination throughout disaster risk management can bring stakeholders to reinforce their response resources for improved performance. Constricted database on the other hand limits response capacity of organisations in this regard.

Coordination networks of stakeholders may enhance collective enforcement of FRM strategies of stakeholders. In the event of successful coordination, FRM resources can be shared to enhance stakeholder performance in risk management. These capacities are products of institutional practices of deliberation, coordination, implementation and evaluation (Hutter, 2006). Poor and fragmented cooperation

networks of organisations may be a challenge for resilience of the response process and structure (Gough & Yankson, 2001; Songsore *et al*., 2009).

The concept of resilience also explains an organisational capacity for reliable performance in the wake of an unforeseen course of disasters. Boin & Schulman (2008) argue, in their work on the 2001 accident of the National Aeronautic Space Agency (NASA) that, the organisation's culture of safety failed due to organisational decision-making flaws. Staw *et al*. (1981) argue that incremental and radical changes of risk can be a threat to organisational management of disaster risk. An incremental change refers to an expected change, which is usually gradual and low in magnitude while radical change refers to unexpected changes in the course of disasters (Staw *et al.*, 1981; Wildavsky, 1991; Christianson *et al*., 2009; Hutter, 2011). It is a change that management stakeholders may have expert knowledge about (Weick & Sutcliffe, 2007).

Response capacity of stakeholders can help to deal with various changes that may lead to flood disasters. These changes may be incremental or radical, mega or minor, sudden or expected and long-term. Whereas incremental change maybe be slow and accumulate overtime, a radical change is rapid. Physical developments and other human activities in flood-prone areas can accumulate over time become increase exposure to flood hazards. Increase in such developments and exposure to flood hazards may lead to rapid increase in unexpected floods disasters and uncertainties in FRM (Staw *et al*., 1981; Wildavsky, 1991). Such uncertainties necessitate resilience in the process and structure of design and implementation of FRM strategies to deal with unexpected course of disasters. Similarly, changes can also be mega or minor. Tsunami or a 500-year flood may be a mega change that brings overwhelming impacts whereas small changes such as changes in the time of occurrence of flood event, collapse of bridges, diversion of floodwaters from known to unknown channels and breakdown of communication lines can be minor changes (De Bruijn & Klijn, 2001). These are nevertheless, uncertainties that can disrupt response plans and resources care is not taken. Changes can also be sudden and expected in disaster risk management. Flash floods are a sudden and an expected occurrence, which can be hard to control. Long-term changes may be associated with impacts from climate and developmental changes. These could be drought and changes in rainfall patterns in the case of climate change. Societal developmental

changes may be impacts of urbanisation and unregulated development of activities and infrastructure in flood-prone areas. These instances may not be detected via anticipation, and may require resilience in the management strategies to mobilise and distribute response resources (Comfort *et al.*, 2010). Resilience in FRM strategies may play a key role in the successful response to those changes outlined above and expected risks from floods.

Learning as ability of organisations to exploit experience by reviewing structures and processes of response capacities occupies the discussion of the resilience concept. Christianson *et al*. (2009: 846) note that radical changes audit existing management response capacity and can inform the management body to revise its "…response repertoires in ways that improve organisation's performance." Revision strengthens the organising routines (restructuring response capacities and practices) and provides opportunity to remobilise organisational resources via redundancy (Staw *et al*., 1981).

Resilience is also described as redundancy or conservation of response repertoires for responding to unexpected course of disasters (Weick & Sutcliffe, 2007; Christianson *et al*., 2009). Resilience in FRM can be enhanced by reserving resources mainly for response to emergency floods. Redundant resources can enhance the response performance of flood risk managers. The discussion shows uncertainties and lack of common theoretical clarity and practical applicability of resilience for FRM strategies. To operationalise resilience for FRM strategies, the next section proposes a respective framework using general common characteristics of organisational resilience in disaster risk management.

2.2.3 Operationalisation of resilience in flood risk management strategies

The section focuses on the framework for operationalisation of resilience in FRM strategies. Operationalisation refers to the application of the concept of resilience in FRM strategies, involving the specification of a set of aspects with indicators and identifiers for describing resilience. The aspects of resilience describe the characteristics that display resilience in FRM strategies. The indicators are the specific features that describe individual aspects of resilience. Each indicator has specific identifiers. These identifiers were carefully defined to reflect terms for describing the aspects of resilience in FRM strategies. The indicators and their

identifiers are useful for application of resilience in real world FRM strategies. As a complementary to resilience, aspects of anticipation in FRM strategies are defined in Section 2.3.3.

Literature on organisational resilience suggests different characteristics of resilient organisations (Wildasky, 1991; Weick & Sutcliffe, 2003; Wachtendorf & Kendra, 2004; McManus *et al*., 2007; Comfort *et al.*, 2010). The operationalisation of resilience in this thesis reflects on the characteristics of resilience organisations as demonstrated in the following paragraphs. A review of Holling (1996) suggests that flexibility in risk management is an indicator of resilience. In an attempt to describe resilience, Holling (1996: 31-32) explains that, "ecosystems change is neither continuous nor gradual but can be episodic with rare events that can unpredictably change shape at critical times or at locations of increased vulnerability." He further argues that, "spatial attributes are not uniform and have no single equilibria with controlled function but rather destabilising forces far from equilibria" (*Ibid*). This analysis supposes that resilience has characteristics that can be suitable for responding to unpredictable changes regarding the time and location of occurrence of an event. This characteristic of resilience can be interpreted as flexibility, which can enable risk management strategies to deal with unexpected course of disasters.

Furthermore, Holling (1996: 42) argument seems to suggest that flexibility in risk management can consider the "integration of knowledge at range of scales, engagement of the public in exploring alternative potential features, and adaptive designs" in response to unexpected course of disasters. Flexibility may be seen in a management strategy that puts up strategies and processes to respond to flood risk at various scales (e.g. in districts and sub-districts). Flexibility can facilitate a faster mobilisation of resources in FRM strategies to improve the capacity to quickly response to unexpected disasters when they occur. The ability to outsource, monitor and deal with emerging flood disaster risks requires a FRM strategy with high flexibility to obtain response resources from stakeholders of various scales. Flexibility can indicate homeostasis as an aspect of resilience, which also stands to support agile and quick response to flood risk.

Of importance for the operationalisation of resilience in this research are the following Wildavsky (1991) describes strategies of resilience in organisations with characteristics of homeostasis, high flux, omnivory, flatness, buffering, and

redundancy as the principles of resilience. Wildavsky (1991: 120) explains that "redundancy, omnivory, and high flux are analogous to knowledge, wealth and other generalisable resources. The homeostatic principle means pure movement – a reaction for every action, source of information for every component." Homeostasis is an aspect of resilience in FRM strategies with a capacity to propel a more advanced awareness of unexpected course of flood disasters that allows for subsequent response. These principles are generic for organisational resilience in risk management and relevant for the current research.

A resilient organisation also possesses an aspect that describes the flow and exchange of information, as well as response resources for dealing with the course of flood disasters. This aspect follows the high flux principle of resilience proposed by Wildavsky (1991). The high flux principle compensates for delay and failure in the supply of response resources by speeding up their provision for response to unexpected risk (Ibid). The omnivory principle of resilience allows for a greater use of a variety of resources supplied through a larger number of routes (Ibid). Wildavsky (1991) further explains that "the flatness principle guards against the size of disaster risks that could overwhelm the intelligence of management "by providing for several decision makers rather than a single actor" (*Ibid*: 120). Flatness principle directly applies aspect of resilience in FRM strategies that encourages decentralisation and inclusion of all key stakeholders in FRM. A key indicator of this aspect can be multiple actors from organisations of various levels of the study site. The principle of buffering is "a generalised capacity to respond to the unknown, by providing the capacity in excess of immediate needs" (*Ibid*). The principle of buffering is a useful aspect of resilience in this research. It can be a FRM strategy to respond to excess of unexpected flood risk and impacts. The principle of redundancy ensures reliability of performance in response to unexpected risk. This principle can be seen in duplicating of response resources to enhance efforts to rectify risk in the course of flood disasters. Sources of response resource can also be duplicated. Response resources for FRM can come from independent organisations and individuals from various capacities and levels of governments.

In their analysis of climate change risks management policy framework of the City of Rotterdam in the Netherlands, Wardekkar *et al.* (2010: 988) operationalise resilience using the same principles proposed by Wildavsky (1991) as follows:

- Homeostasis: multiple feedback loops to counteract disturbances;
- Omnivory: vulnerability is reduced by diversification of resources and means;
- High flux: a fast rate of movement of resources through the system ensures fast mobilization of these resources to cope with perturbations;
- Flatness: the hierarchical levels relative to the base should not be top-heavy. A centralised risk management with a high hierarchy without local management competence to act on emergency flood risk can be inflexible. A situation like this can slow down swift response to emerging disaster risks;
- Buffering: essential capacities are over-dimensioned such that critical thresholds in capacities are less likely to be crossed;
- Redundancy: overlapping functions; if one fails, others can take over.

However, Wardekkar *et al.* (2010) operationalise resilience in the sense of adaptation to climate change risks whereas Wildavsky (1991) applies the concept in response to threat from disastrous events (e.g. a flood event) after they have occurred. The latter is more related to how resilience is operationalised in this research since it focuses much on response to unexpected course of disasters which is relevant for risks of a proceeding flood event. Ideas from Wardekkar *et al.* (2010) are also relevant because flooding is an impact of climate change. The meaning of the principles of resilience is an important criterion for defining the indicators and the identifiers of aspects of resilience in FRM strategies.

Resilience in risk management is described in the diversity of organisations involved in response to unexpected course of disasters. Homeostasis describes this characteristic in FRM by which multiple organisations are seen as multiple feedback loops in risk management. FRM as a societal process consists of multiple social actors including local, regional, state and international organisations who organise themselves to engage in various activities towards FRM (Hutter 2006; Schanze, 2006, 2009; WMO 2006). Hereby, FRM can be described as inter-organisational.

In a research on benchmarks of resilience in organisations, McManus *et al*. (2007) reveal that organisational resilience in a complex, dynamic and interrelated environment is a function of an organisation's overall situation awareness, keystone vulnerabilities and adaptive capacity. McManus *et al.* (2007: 6) explain the overall

situation awareness by arguing that, “in order for resilience management to be effective, an organisation must have a clear understanding of the issues that contribute to its resilience, in a day-to-day environment as well as in a potential crisis.” Indicators of awareness referred to knowledge about roles of actors, risks and consequences of organisations. Indicators of Keystone vulnerabilities consisted of risk management planning, resources and networks of organisations. Indicators of adaptive capacity included leadership and the management vision of organisations.

The indicators of the benchmarks of resilience are similar to indicators of the aspects of resilience in FRM strategies. McManus *et al*. (2007) focus on resilience of individual organisations but not the inter-organisational aspect of risk management. Organisational resilience in risk management of public organisations has an inter-organisational coordination and interdependency too (Comfort, 2005). Operationalisation of resilience in FRM strategies also considers inter-organisational relationships of multiple organisations in response to flood disaster risk. Although the study by McManus *et al*. (2007) focuses on the management of individual organisational risk, the benchmarks of resilience applied in their study, operationalisation resilience in FRM strategies makes of use of the indicators of the benchmarks. The benchmarks of resilience are similar to the aspects of resilience that are used in this research. For instance, the situation awareness used in McManus (2008) is similar to homeostasis of the FRM strategy applied in this research. Moreover, the indicators of the benchmarks of resilience also have common features with respect to the indicators of the aspects of resilience in FRM strategies (applied) in this research.

Comfort (1994: 175) describes resilience in organisational risk management with four characteristics. Namely, “a capacity of creative innovation among organisational units that interact as a system to achieve a common goal; flexibility in relationships of parts of the system and the whole; interactive exchange between the system and its environment; and a crucial role for information in increasing either order or chaos, regularity or random behaviour within the system.” Comfort *et al.* (1994) applied those characteristics of resilience in the mobilisation of resources in response to disaster risks of the Northridge Earthquake of January 1994. Resources may refer to personnel, financial, material, logistics and information. Sources of these resources including internal, external, and redundant for resources for response were

considered in the discussion. Platforms for information sharing and stakeholders coordination become useful data for addressing this research question. Diagne (2007) argue that inadequate access to resource such as physical and social infrastructure is common challenges of FRM in developing nations. This spatial difference shows a need for consideration of vulnerabilities in the context.

The characteristics of resilience outlined by Comfort *et al.* (1994) are similar to the operationalisation of resilience in FRM strategies. The characteristic of a capacity of creative innovation among organisations is relevant for a more coordinated response to disaster risk. A more effective coordinated network of stakeholders involves a continuous feedback loop of information and knowledge exchange to facilitate a timely response to risks of flood disasters. Flexibility in management of the parts and whole of the risk system can refer to a management approach that involves stakeholders (actors) within district, sub-district and community levels to respond to flood disaster risk. This approach can also ensure that risk information is well monitored, coordinated and crosschecked to be shared before, during and after a flood event.

Characteristics of resilience in high reliability organisations whose ultimate goal is resilience in performance to ensure safety also informed the operationalisation of resilience in FRM strategies (Weick *et al.*, 2008). Resilience in high reliability organisations further refer to situation where managers possess mindfulness of failures, tendencies to simplify, current operations, capabilities for resilience, and temptations to over-structure the system (Weick *et al*., 1999; Kendra & Wachtendorf, 2003). Boin & Eeten (2013: 433) outline the features of high reliability organisations and insist that, “high technical competence through the organisation; a clear awareness of hazards and vulnerabilities; an elaborate and evolving set of procedures and practices, which are directed towards avoiding disastrous events from happening; a formal structure of roles, responsibilities and reporting relationships that can be transformed under emergency conditions into decentralised, team-based approach to problem-solving; and a culture of reliability that distributes and instils the values of care and caution, respect for procedures, attentiveness and individual responsibility for promotion of safety throughout the organisation.” These features indicate structures and process facilitate mindfulness of threats and errors in high reliability organisations. Mindfulness is interpreted as

awareness of unexpected course of disasters as well as thoughts of possibilities for failures. Mindfulness and its indicators can be meaningful for the homeostatic aspect of resilience in FRM strategies.

The operationalisation of resilience in FRM strategies takes inspiration from the principles of resilience in organisational management proposed by Wildavsky (1991). Resilience of organisations can be synonymous with high reliability performance of organisations (Weick *et al.*, 1999; Wachtendorf & Kendra, 2003). The operationalisation framework further reflects on further characteristics of resilience in organisational risk management (e.g. Comfort, 1994; Hollnagel & Woods, 2006; McManus, 2007; Comfort *et al.*, 2010) and also from international policy documents on disaster risk management resilience (e.g. ISO: 22301, 2012; UNISDR, 2015).

The specific indicators give comprehensive meaning to the resilience aspects with refined manifestations, referred to as identifiers. The indicators describe the specific aspect of resilience in FRM strategies, referring to only their qualitative characteristics. The classification of the indicators considers closely related features to give detailed description to individual aspects of resilience. Indicators for omnivorousness of the FRM strategy refer to the diversity of sources of response resources and responses within and among organisations. Diversity of sources of responses explains multiple organisations from different levels of society that contribute resources for responding to flood risks whereas diversity of responses refer to the variety of strategies the key stakeholders apply for FRM.

Agile and timely flow of response rate of the FRM strategy is an aspect of resilience that establishes conditions for a fast distribution of resources in response to unexpected course of flood disasters. Strategies for a real-time monitoring, forecasting and warning of flood event within and among organisations are a useful indicator that provides access to information for response action. Moreover, a decentralised availability of response resources within and among relevant organisations brings resources close to hotspots of flood risk for easy access during disasters. This aims to reduce traveling time and distance to facilitate quick response.

Table 1 Aspects for describing characteristics of resilience in FRM strategies

Aspect of resilience in FRM strategies	General definition	Indicators	Identifiers
Omnivorousness of the FRM strategy	Diverse kinds of resources used by the system and the pathways through which resources can flow to dominant system components, the less like is the system to become unstable because of a supply failure of a single resource (Wildavsky, 1991: 113) Idea of spreading risk (Wardekker *et al.,* 2010)	*1.1 Diversity of sources of response resources* within and among organisations	1.1.1 High diversity of actors providing responses (levels &sectors and state & non-state organisations) through protocols and agreements response interventions 1.1.2 Expert knowledge based plus local knowledge-based management
		1.2 *Diversity of responses* within and among organisations	1.2.1 More consideration for pre-event, event and post-event measures
Agile and timely flow of response rate of the FRM strategy	*Conditions for quick distribution of resources.* The higher the rate of resource flux through the system, the more resources are available per unit time to help deal with perturbations (Wildavsky, 1991: 113)	*2.1 Real-time monitoring, forecasting and warning of flood event* within and among organisations	2.1.1 More structures and logistics for continuous monitoring, forecasting and warning of the course of flooding and its impacts
		2.2 Decentralised availability of response resources within and among relevant organisations	2.2.1 Readily available response resources for stakeholders at local and unit level
		2.3 Arrangements for continuous	2.3.1 More continuous network of communication

Aspect of resilience in FRM strategies	General definition	Indicators	Identifiers
		cooperation within and among organisations for rapid response	(e.g. pager) 2.3.3 More regular (inter-) organisational emergency response training and exercises)
		2.4 Flexibility in rapid response	2.4.1 More decision space with mandate for immediate action
Homeostasis of the FRM strategy	Awareness and maintenance of FRM strategy based on reflection, learning etc. (Wildavsky, 1991: 114)	*3.1 Awareness about the unexpected course of flood disasters* within and among	3.1.1 High awareness about the need for continuous tracking of information on the development of flood hazard and risk.
	Awareness and knowledge of the FRM strategies (McManus *et al.* 2007)	*3.2 Coordinated learning about previous FRM performance* within and among organisations	3.2.1 More binding agreements on regular reviewing (assessment) of FRM strategies after flood events with their impacts 3.2.2 More common platforms for (inter-) organisational dissemination of flood risk information
Flatness of response process and structure of the FRM strategy	The wider the base of inter-organisational pyramid, relative to the number of hierarchical levels, the more persistent the functions of management strategy can be (Wildavsky, 1991: 114)	*4.1 Decentralised decisions* on implementation of responses to flood events and their impacts within and among organisations	4.1.1 Stronger legal provision, protocols and agreements for emergency response of local or unit levels 4.1.2 More interactive relation of organisations in emergency response to the course of flood disasters and

Aspect of resilience in FRM strategies	General definition	Indicators	Identifiers
			flood impacts 4.1.3 More comprehensive participation of all key stakeholders in decision on design and implementation of measures and instruments for flood risk and disaster reduction
Redundancy of response resources for FRM	Redundancy insures reliability: resources reserved, lay slack, and saved for possible use during crisis (Wildavsky, 1991: 115)	*5.1 Additional resources* within and among organisations	5.1.1 More savings and reserves of organisations for emergency response in the organisations 5.1.2 High coordination of additional resources among organisations 5.1.3 Higher design of measures and instruments beyond determined probabilities of flood risks and disasters
Buffer capacity of the FRM strategy	Capacity for beyond designed performance (Wildavsky, 1991: 116)	*6.1 Additional performance of risk reduction measures* of organisations	6.1.1 More performance of the designed and implemented risk reduction measures beyond known (determined) flood risks

Source: Adapted from Wildavsky (1991)

An arrangement for continuous cooperation within and among organisations for rapid response is to establish a platform for quick access to information and knowledge among organisations in FRM. This is important and it describes readiness for immediate action in response to emerging risk from a flood event. Flexibility in rapid response is to allow organisations to deal with unexpected course of disasters during floods organisations without rigid procedures of protocol.

Homeostasis of the FRM strategy has indicators for its description. Homeostasis concerns mindfulness and knowledge that facilitate alertness in response to unexpected course of flood disasters. A catchword for indication of homoeostasis is awareness. Awareness about the unexpected course of flood disasters within and among organisations is applied to describe homeostasis. Conditions in the strategies that show a continuous tracking of information on the emergence of risk during a flood event is identifier of this indicator. Coordinated learning about previous FRM performance within and among organisations is another indicator for homeostasis. It is a learning effort that aims at improving knowledge regarding the strengths and weakness in a real response to floods and interventions for a more expert performance in the future. Conditions for a more binding agreements for regular reviewing (assessment) of FRM strategies after flood events is an identifier for this indicator. Additional identifier refers to signs of common platforms for (inter-) organisational dissemination of flood risk information.

Flatness of response process and structure of the FRM strategy refers to decentralisation on decisions in response to emergency risk during flood events. During flood events, quick decisions and responses are required to curtail escalating flood impacts. Identifiers for this indicator are not farfetched. One refers to strong legal provision, protocols and agreements for emergency response to emergency flood risk at sectoral and local units of organisations. This provision can enable quick responses without much delay. Besides, a more interactive relation of organisations in emergency response to course of flood disasters assists to identify this indicator. Another identifier points to a more comprehensive participation of all key stakeholders in decision on design and implementation of measures and instruments for flood risk and disaster reduction. Multiple organisations participate in FRM.

However, a more open management can better incorporate all key stakeholders in decision-making and implementation of risk management strategies.

Redundancy of response resources for FRM aspect refers to resources that are reserved for response crisis of a flood event. Additional resources within and among organisations is a clear indicator for this aspect. Conditions for more savings and reserves in organisations for emergency response are a good identifier. Moreover, a high coordination of additional resources among organisations broadens the base of reserves in this regard and serves as an identifier. In the areas of structures for dealing with unexpected flood risk, a higher design of measures and instruments beyond determined probabilities of flood risk is a good identifier for a capacity to deal with the unknown flood impacts.

The resilience aspect, buffer capacity of the FRM strategy, refers to the capacity for beyond designed performance during flood events. This emphasises the ability to deal with flood risk beyond the anticipated flood disasters. An indicator of this aspect shows conditions for additional performance of risk reduction measures in FRM organisations. Specific identifier for elaboration of this indicator considers settings that conducive for a performance of the designed and implemented risk reduction measures beyond known (determined) flood risks. This can reflect in areas of drainage and land-uses that can open or impede space of floodwaters.

Table1 specifies the aspects of resilience in FRM strategies following the discussion above. The principles of anticipation are considered in this study. This follows the position of Wildavsky (1991) that a combination of the principles of anticipation with the principles of resilience is a way forward for resiliency in risk management of organisations. Wildavsky (1991: 113 -120) specifies the following principles of anticipation in pursuit of resilience in organisational risk management: Safe environment principle, implying that by locating an entity in a safe environment that can keep the entity safe and stable from exposure to high-risk environment.

- Advance environmental modification is a strategy by which organisations can modify the environment and their strategies to cope with risk factors.

- Patchiness principle works on spatial heterogeneity and idea of enclaves of risk so that a course of flood risk does not spread to other areas.

- Overspecialisation is conceived in a narrow niche to respond to specific risks.
- System separability is a state by which disturbances can be isolated as and when they occur.
- Robustness concerns with the idea that a robust entity can passively withstand a wide variety of external shocks.

These principles of anticipation can deal with expected risks. Anticipation may stop preventable disasters from occurring or reduce their probability of occurrence and magnitude of impacts if they occur. In a generic sense, these principles of anticipation in FRM strategies can be described as features of risk management that focused on responding to flood hazards, vulnerability and exposure as well as impacts of flood. These principles of anticipation are designed from anticipatory planning with the aim to predict and resist flood risks as well as mitigate flood impacts.

Resistance in this research is to ensure a safe environment in the face of threats from flood risk. This is related to the principles of anticipation in the sense of its focus on ensuring safe environment, robustness to risk, and separability of elements at risk from flooding (Wildavsky, 1991; Wardekker et al., 2010). FRM may include separating flood vulnerable elements from flood hazards. Resistance to known risk in the FRM strategies is one aspect of anticipation.

Resistance to known flood risk is an aspect of FRM strategies describes anticipatory planning for managing determined flood risk. Structures for flood risk governance need to establish to enhance prediction and reduction of flood risks. Indicators of resistance may include structures of flood risk governance referring to rules, regulation and specific stakeholders with defined roles. These can also involve plans, procedures and approach to FRM. The process of FRM involving the analysis, assessment and reduction of flood risk is crucial (Schanze, 2006). This interpretation supports the aspect of anticipation regarding resistance to known flood risk as in Table 2.

Maintenance of FRM measures and instruments is considered an aspect of anticipation and it focuses on dealing with modifications of threats of flood risk and

management measures (Wildavsky, 1991; De Bruijn, 2005; ISO 22301, 2012). Modification can refer to changes in boundary conditions of FRM strategies, which can require corresponding changes in these strategies. Maintenance can sustain the designed functions of FRM measures (instrument).

Anticipation also involves the definition of expertise who can deal with specific flood disaster risks that affect specific sectors of society. Floods have various risks including risks on health, economy and ecosystems. FRM may involve stakeholders whose responsibility may focus on pre-FRM. Other stakeholders may also specialise in emergency or post-flood event management. Managers of flood risk can also specialise to deal with specific risks of floods. This aspect of anticipation is similar to the principle of overspecialisation (Wildavsky, 1991) and over-simplification (Wachtendorf & Kendra, 2003).

From the review of the principles of anticipation presented above, as well as the literature review on FRM presented in the Chapter 2 of this thesis, the aspects of anticipation in FRM strategies and their indicators are specified in Table 2. Similarly, the identifiers describe the indicators and aspects of anticipation in FRM strategies. Predictable conditions of flood risk can play a role in designing and formulating strategies for FRM (WMO, 2006). This perspective of FRM assumes complacency on engineered structures and processes for controlling flood risk and reducing impacts of flood disasters.

Table 2 shows aspects of anticipation in FRM strategies with specific indicators and identifiers. These aspects are generic and not prescriptive for a specific FRM. The indicators with the corresponding identifiers are elaborated in description of the the various aspects of anticipation in FRM strategies.

Resistance to known flood risks is first aspects of anticipation. It describes the FRM strategies that are available for preventing, protecting and reducing expected flood risk. Specific role and responsibility of organisation is an indicator for describing conditions through which stakeholders in FRM are assigned roles. This indicator can be identified by legislative instruments defining specific roles and responsibility of organisation in design and implementation of FRM measures Moreover, an assessment of flood risks within and among organisations can be an indicator for resisting flood risk that have been identified. Evidence of identifers for this indicator

can be seen in attempts at mapping of flood risk that have been identified risk identification and assessment. Documentation risk can be seen in risk maps or reports as evidence. The third indicator for resistance to know flood risk is consideration of long-term change within and among organisations in FRM strategies. Condition of scenarios of long-term climate and societal change impacts on floods is the first identifier for this indicator and the second is scenarios of long-term climate and societal change impacts of flood risk. These scenarios can project the future of flood risks based on changes in the patterns of rainfall and other climate conditions as well as changes in societal development. The fourth indicator refers to evidence of measures and instruments for flood risk reduction.

This indicator can be identifiers of pre-flood risk reduction measures and instruments designed and implemented, flood event risk reduction through defined measures and instruments and post-flood risk reduction through defined measures and instruments. These instrument and measures of FRM mean to address expected flood risk before, during and after a flood event.

The second aspects anticipation refers to maintenance of boundary conditions of FRM strategy. Indicator for describing this aspect is the means of reinforcement of implemented measures within and among organisations and has three identifers. Regulations and protocols for mandatory reports on review of implemented measures and instruments, maintenance of instruments and measures according to their design and retraining of staff about the defined processes in response to flood hazards and risk are specific identifers for this indicator.

The third aspect of anticipation is described by evidence of specialisation in dealing with specific courses of flood disasters. Sometimes, flood risks require specialised expertise for resisting development into disasters. Conditions of sector-based approach to flood risk and disaster reduction is a good indicator that can be expressed as identifier. This can be explained by indications of special sector plans for individual organisations in the process of FRM.

Table 2.**Aspects for describing characteristics of anticipation in FRM strategies**

Aspects of anticipation in FRM strategies	General definition	Indicators	Identifiers
Resistance to (known) flood risks	*Ability to predict and reduce* flood risks	1.1 Specific role and responsibility of organisation	1.1.1 Legislative instruments defining specific roles and responsibility of organisation in design and implementation of FRM measures
		1.2 Assessment of flood risks within and among organisations	1.2.1 Mapping of flood risk
		1.3 .Consideration of long term change within and among organisations	1.3.1 Scenarios of long-term climate and societal change impacts on floods
		1.4 Measures and instruments for flood risk reduction	1.4.1 Pre-flood risk reduction measures and instruments designed and implemented
			1.4.2 Flood event risk reduction through defined measures and instruments
			1.4.3 Post-flood risk reduction through defined measures and instruments
Maintenance of boundary conditions of FRM strategy	Practices to *reduce the extent of fluctuations* to which the key stakeholders have to respond	2.1 Means of reinforcement of implemented measures within and among organisations	2.1.1 Regulations and protocols for mandatory reports on review of implemented measures and instruments.
			2.1.2 Maintenance of instruments and measures according to their design

			2.1.3 Retraining of staff about the defined processes in response to flood hazards and risk
Specialisation in dealing with specific courses of flood disasters	*Creating niches for specific issues* of flood disasters based on advantage of special provisions of organisations	2.3 *Sector-based approach to flood risk and disaster reduction*	2.3.1 Special sector plans for individual organisations (saving life and property, ecosystem, livelihood, reconstruction)

Source: Adapted from Wildavsky (1991)

In summary, the basic concepts and the conceptual framework for this study are explained in Chapter 2. The chapter introduced the conceptual pillars for this research. With this information on the basic concepts and the conceptual framework from this chapter, it is important to discuss the research design and methods in the Chapter 3 next.

3 Research design and methods

In this chapter, the overall design and specific methods for the study are presented. The approach is inductive and qualitative, and follows a single case study research design. Details of this approach are explained in Section 3.1. Section 3.2 encompasses the methods for data collection, analysis and interpretation to address the specific objectives and their corresponding research questions. It examines methods such as documents analysis, sampling techniques for selecting the research participants, semi-structured expert interviews and a stakeholder validation workshop through group discussion. The hypothesis derivation approach is also introduced, taking into account its conceptual and practical perspectives. Relevant research ethics and challenges of the study of this study are discussed.

3.1 Research design

3.1.1 Overall design

The overall research approach is an inductive qualitative design. This design helped to obtain in-depth data for this research (Hay, 2010; Babbie, 2012). The inductive design was useful due to lack of respective theory for this research. The main data for this research are qualitative, as they seem most relevant for descriptive and interpretative analysis of resilience in FRM strategies of the study site, where data availability and accuracy is a challenge. The qualitative research design provides opportunity for the researcher to explore possible sources of data, and sort out relevant information for analysing the problem being researched. Unlike its quantitative counterparts, the qualitative method enables the researcher to obtain and piece together data from documents and volumes of transcripts of interviews with the research participants. Qualitative research is useful and capable of helping to acquire such knowledge from individuals about their activities and experiences of the phenomenon under investigation (Crang & Cook, 2007; Babbie, 2012). Other studies in disaster risk management applied similar research design (Songsore *et al*., 2005; Diagne, 2007; Christianson *et al*., 2009; Lopez-Marrero & Tschakert, 2011).

The main sources of data for this research are policy documents and expert interviews. The documents and the interviews complement each other to provide

insightful information about the problem under study. The combination of these data sources is ideal, as one source of data is not sufficient for analysing the problem. Triangulation of documents analysis and interviews is relevant for understanding the research problem, particularly in a developing world context, where solid documentation and reliable databases hardly exist (Akemkpor, 2002). The research design is descriptive analysis and focuses on obtaining qualitative data about FRM strategies in the city of Accra. Descriptive design offers researcher opportunity to get rich information for describing flood risk, stakeholders and their FRM strategies.

The scope of this research focuses on FRM strategies of organisations in responding to the course of flood disasters and impacts in Accra. Accordingly, only organisations of FRM in the study are were investigated. The city of Accra is located the Accra Metropolitan Assembly administrative area. Hence, the study does not consider FRM outside the administrative areas of Accra. The scope is limited to organisational and inter-organisational FRM strategies and does not account for citizens personal capacities to cope with flood risk.

3.1.2 Case study approach

The research follows a single case study approach. Yin (2003) explains that case is helpful in gaining in-depth understanding and explanation of social phenomena. Yin (2009: 18) offers two working definitions for case study that are relevant guide for this research: First, a case is “an empirical inquiry that investigates contemporary phenomenon in-depth and within real-life context, especially when the boundaries between phenomenon and context are clearly evidence.” This definition provides the basis for the design of this research. FRM is a real-world problem, but limiting the scope to the city of Accra gives a sense of geographical focus for an in-depth investigation (Babbie, 2012; Hay, 2010).

Second, Yin (2009: 18) argues that a case study “inquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result relies on multiple sources of evidence, with data needing to converge in a triangulation fashion, and as another result benefits from the prior development of theoretical propositions to guide data collection and analysis.” Similarly, this research relies on data from individual face-to-face interviews with representative of various organisations and multiple documents to investigate the

problem. Archives, personal observation, photographs and stakeholder workshops (or focus group discussion) also constitute important sources of data for case studies (Hay, 2010). Data from these methods (documents analysis and interviews) provide a comprehensive understanding of the FRM strategies.

Additionally, this research describes resilience in FRM strategies for an in-depth understanding of the problem at the study site. A case study research design is a useful approach for descriptive, explanatory and interpretative analysis of a phenomenon being investigated (Yin, 2003, 2009). Answers to the questions of this research require comprehensive description and analysis of the problem under investigation. This approach yielded useful results for development of the hypotheses.

The general case study approach is also applied to enable the researcher to describe aspects of resilience in FRM strategies of key stakeholders in Accra. The empirical findings are the aspects of resilience in FRM strategies. Additionally, findings on the aspects of anticipation in FRM strategies are also presented and interpreted. The description reveals the extent each aspect of resilience and anticipation in the FRM strategies. The degree of the aspects in the strategies becomes a guide for the development of the hypotheses.

3.1.3 Research ethics and access to data

The researcher followed scientific procedures and documentation to ensure ethical standards in social science research. This includes ensuring transparency and of objectivity of the study and authenticity of data and findings of the research (Babbie, 2012). Data handling plays a major ethical role in qualitative research (Howes *et al*., 2006). Preliminary consultations were made with the research participants before the actual interviews. This was to establish trust and rapport between the researcher and the research participant. Research ethics also requires that the researcher contacted interviewees to explain the purpose of the research and obtain permission for the interviews (Crang & Cook, 2007). Before the interviews, interviewees were made aware that their participation in the research was voluntary and they have the right stop the interviews at will. Permission was sought from the research participants before recording the interviews.

The research participants are informed that the raw data obtained would not be made public, but the analysis of the results and research findings would be available. To ensure credibility of the results, the researcher also contacted the interviewees after the interviews to validate the data. Although key points of the interviews were written in a notebook, an audio recording device is used concurrently to record the data. These two recording tools were used complementarily to ensure the security of the interview data. The audio records enable the researcher to repeatedly listen to the interviews for transcription. The interviews are kept confidentially for the purpose of the research; only the researcher and the academic supervisor have access to these interviews. Convenience and safety of the researcher and research participants were considered in determining venues for the interviews. Most of the interviews were held in offices of research participants. A few of them took place in private cars of the interviewees.

The following strategies were also employed to get access to data, before and during the empirical work. Preliminary contacts were established before the field visit to facilitate rapport between the researcher and the organisations in FRM of the study site. Organisations of FRM were contacted through telephone calls and e-mails for preliminary information before travelling to the study site for empirical work. Two gatekeepers also assisted in getting access to the research participants and relevant documents for this research. The gatekeepers were strategically chosen to enable the researcher get access relevant organisations and rich data.

Both gatekeepers work with National Disaster Management Organisation (NADMO) of Ghana. One works with the national headquarters of NADMO while the other works with the office at the Accra Metropolitan Assembly (AMA). The gatekeeper from the national headquarters was resourceful in terms of contacts with international, national and regional organisations of FRM, while the other from the AMA office has local contacts relevant for the data collection. The gatekeeper from the AMA was also the secretary and a member of the Accra Metropolitan Assembly Disaster Management Committee. This committee is responsible for managing disaster risks of the study site. FRM is one of its top priorities since it is most prevalent of all disaster risks in the study area. The interviews began with formal consultations for preliminary introduction and arrangements for the interviews. Letters of introduction from supervisors of the researcher and affiliated institutions

are presented during the preliminary consultations. The letters endorse the local and international support for the study. The letters facilitated access to organisations and research participants for the interviews.

3.2 Data collection methods

This section has three sub-sections. Namely - sampling techniques, document analysis and expert interviews.

3.2.1 Sampling techniques

The researcher used purposive and snowballing sampling techniques to identify the relevant research participants for the interviews. Purposive sampling is applied because the study has a particular interest in individual in organisations that are experts in FRM (Hay, 2010). Some of these organisations are mentioned in existing disaster risk management policy documents and can be reached for the interviews. Representatives from the public, private, and civil society organisations who play roles in FRM as actors are contacted. Principal heads of organisations or administrative units were the primary research participants for the interviews. Where principal heads were unavailable, their representatives were considered. These research subjects hold a position (authority) to play roles and make decision in FRM. The representatives therefore granted the interviews on behalf of the organisations of FRM. After each interview, snowball-sampling approach becomes to identify additional relevant research participants for further interviews. Snowballing was used to identify potential stakeholders who are not captured by policy documents and reports on FRM being reviewed.

After analysis of the data on the key stakeholders in FRM, a stakeholder validation workshop was conducted. The workshop was useful to confirm the list of key stakeholders. It was also meant to capture relevant data (key stakeholders) that might had not been captured by the face-to-face interviews. Other data sources were used to complement the interviews.

3.2.2 Documents analysis

Documents are sources of information for understanding the antecedence of flood risk, knowing the stakeholders and strategies of FRM (Scott, 1990). The documents analysis provides initial data for identifying potential key stakeholders in FRM. Documents are a repository of human communications that are relevant for this

research. Relevant documents on FRM, such as reports and policy documents were obtained from organisations and studied. Secondary sources of data included reports and policy documents such as the; Ghana National Disaster Management Action Plan 2010, Operational Response Procedures (NADMO, 2010), National Urban Policy (Government of Ghana, May 2012), Constitution for the Republic of Ghana and Annual Flood Disaster Risk Reports of NADMO (2007, 2009, 2010, 2011, 2012). Reports on flood disaster risks from the NADMO office of the Accra Metropolitan Assembly are also rich sources of data for this research. These documents have data on specific FRM stakeholders and their roles in FRM. Specific reports and policy documents about FRM activities of various organisations were also studied.

3.2.3 Expert interviews

Expert interviews were conducted with representatives (mainly directors or their representatives) of organisations that involved in FRM in the city of Accra. In all, thirty-one interviews were conducted. Expert interviewing method was used as a plausible means to obtain detailed data of key stakeholders and their strategies for FRM in the study site (Lebel *et al*., 2006; WMO, 2006). Face-to-face individual interviewing approach was used. This approach enabled the researcher to gather expert ideas from individuals who represent the organisations in FRM. The research participants were selected as individuals with authority and experience in FRM of the city of Accra. The authority refers to the expertise of the research participants in FRM and representation of the organisations. Individual expert interviews become useful for collecting comprehensive data to answer the research questions since there is room for probing in the data collection process (Babbie, 2012).

Hay (2010, 99) pointed out that interviewing “is so much more than having a chat. Successful interviewing requires careful planning and detailed preparation.” As part of the preparation for the empirical, a semi-structured interview guide was designed. The structure of the interview guide is important for the quality of the data. The interview guide was used as a toolkit for the data collection and a compass for the pattern of the interviews. The interview guide was structured into sections. The main themes included the state of flood disaster risk, the identification of stakeholders in FRM, the FRM strategies and the analysis of resilience in the FRM strategies. The researcher applied the indicators and aspects of resilience to obtain data about

resilience in FRM strategies. The descriptive indicators of the aspects of resilience were applied in the interview questions. This strategy was to avoid misinterpretation, confusion and to ensure that relevant data were obtained. The sequence of the topics in the interview guide follows the order of the research questions and objectives of this study.

The interview questions are mainly open-ended. This strategy was chosen to ensure that the interviews are conversational for obtaining narrative information on the topic. Open-ended interview questions are useful for obtaining comprehensive data to answer the research questions (Crang & Cook, 2007). This method gives interviewees opportunity to explain their ideas about the topics. The topics, captured by specific sections of the interview guide made the interviews more focused and also allowed the researcher to regulate the conversation. The structure of the interview guide focused on the research objectives. The interview questions unfolded from question on key stakeholders of FRM to questions about resilience in their management strategies.

The interview guide for this research was rigorously scrutinised and evaluated to ensure its credibility in obtaining useful data for the research. For instance, comments from the supervisory team added more value to its structure and clarity. It was tested with two individuals from the Head Office of the National Disaster Management Organisation and the Secretary to the Accra Metropolitan Assembly Disaster Management Committee. This approach was to ensure that the language of the interview guide is practical and understandable to the actors of FRM.

Pre-interview arrangements were made in scheduling the interviews to ensure the appointments were honored. The arrangements also enabled the interview participants to prepare in advance for the interviews. There was a potential challenge for some participants to give more data than required. This is usually with open-ended interview questions and the researcher had to strategically transition the interview to the next question. Interviewees had expertise in FRM of the study site. Howes *et al*. (2006) stress that fixing interview schedules with research participants in developing world can be major challenge due to conflict with other official duties of the participants. This was a challenge during the data collection for this research because some appointments for the interviews and collection of documents due to

official duties of the interviewees. However, this challenge can be minimised by rescheduling and requesting for alternative representatives of the organisations.

The data were obtained from respective international government department, national, regional, district, private sector and civil society organisations of FRM. Traditional authorities (council of chiefs) also offered relevant data for the study. The interviews provided data to answer the research questions 1 and 2.

3.3. Data analysis

In this section, content analysis, which helps the researcher to interpret relevant interview quotations of specific themes and categories, was used as a data analytical approach for this study. Content analysis is appropriate for research that draws data from human communications (Babbie, 2012). The analysis of the interview data begins with a transcription of the interviews from audio to text, coding of the transcripts and then presenting and interpreting these codes according to the objectives of the research (Bryson, 2004).

Scholars further argue that qualitative interview data analysis begins with the data collection in the field (Crang & Cook, 2007; Hay, 2010). This is because notes of the data are taken from the onset, and this process can be selective to cover the key points of the interviews. In this research, the interviews were mainly recorded with audio device, and key points jotted down in a notebook. The notes became helpful when some portions of audios were not audible due to noise. Each interview was repeatedly listened to and relevant portions transcribed. The portion of the audio is considered useful when the text contains messages for describing and explaining the objective and theoretical basis of this research. Transcripts contain words, phrases and sentences that make meanings for answering the research questions. Relevant portions of the transcripts were coded and selected for data analysis.

Babbie (2012) explains that content analysis involves a process of coding data into standardised forms, and grouping them into categories and themes before interpretation in an iterative fashion (see also Crang & Cook, 2007). Selection of specific relevant text (words, phrases, sentences) from the interview transcripts focussed the aspects of resilience and anticipation in FRM strategies. The transcripts were further read iteratively to search for key texts that contain theoretical terms and narratives for describing key stakeholders of FRM and their strategies on the city

level in Accra. In the coding process, patterns of the text in the interviews guided the interview codes that were selected. The selected codes have common patterns in the interviews.

The indicators of resilience and anticipation aspects contained in the conceptual framework for operationalisation of resilience in FRM strategies formed the baseline for coding, and highlighting the selected codes from the transcripts as empirical evidence. The selected codes were highlighted in italics to make them visible from the rest of the text in each transcript. Codes with common patterns were then organised and categorised under themes relevant for interpretation and presentation as results.

Selection and marking of the codes for presentation and interpretation as results followed the breakdown of the identifiers for the indicators of each aspect of resilience and anticipation of FRM strategies. The researcher presented the results as narratives and voices of the research participants describing their understanding of the key stakeholders of FRM and the aspects of resilience and anticipation of their strategies.

Interpretative technique was applied for interpreting the interview codes. Each aspect of resilience and anticipation of FRM strategies is presented and further grouped into categories of indicators. The interpretation draws meaning from the quotation and in reference to other quotations to highlight patterns and emphasis of contradictions.

3.4 Methods for answering the research questions

3.4.1 Research question 1: Stakeholder analysis

This section presents the methods for answering the research question 1 of this thesis. The focus of the methods is on approaches to identify and validate the key stakeholders of FRM in the city of Accra. Thus, stakeholder analysis method is applied in the context identification and validation of the key stakeholders in FRM. Fukati (2010: 1) ascertains that a stakeholder "… refers to anyone significantly affecting or affected by someone else's decision-making activity." This viewpoint conceives a stakeholder from two perspectives. Firstly, an individual is a stakeholder, by contributing to success or failure of a decision-making activity. Secondly, an individual becomes a stakeholder if a decision-making activity affects

such an individual. Situating an organisation or groups of organisations in an individual's position, organisations participate in FRM and can affect management decision making and implementation. This is where stakeholder analysis matters in inter-organisational management of risk of floods to the public. Stakeholder can be a person, group of persons or organisation who are affected by, and/or have influence on decision-making and implementation of management policies and plans **(**Bryson, 2004). Stakeholders in FRM can, therefore, be individuals or organisations that affect decision-making and implementation in this regard. In this research, stakeholders refer to organisations in FRM, and they are regarded as potential key stakeholders if they are players in FRM. A key stakeholder in FRM refers to an organisation that has legitimacy to play a role with influence and urgency in FRM.

Legal or legislative policies and regulations designed to mandate roles of FRM organisations (actors) is an obvious reference point. The existence of regulations defining responsibilities, duties, roles and task of FRM actors are a key indicator for the flow of activities and reduction of conflicts in the management activities. For instance, a constitution may outline which actor plays a leading and coordinating role for risk reduction during event management (Djalante *et al.,* 2012). Early warning is the responsibility of meteorological agency, and spatial planning is the task of the municipal planning department (GIZ, 2012). Regulations allow actors to design policy instruments and measures for risk reduction, and also offer legal backing for their implementation. Insurance, environment and waste management, infrastructure, water management, social service, awareness and public education and early warning policy regulations are all importance to identify. Regulations binding the responsibilities of the actors can be external or internal, depending on the management system in place. The specific policy programmes, their goals and objective were explored. Stakeholders can affect FRM through analysis, evaluation and reduction of flood risk.

Stakeholder analysis was used to answer the research question 1. This approach identifies and categorises the FRM organisations using the main stakeholder attributes of legitimacy, roles (responsibilities), influence and urgency. These attributes help in the selection and description of the key stakeholders in FRM. Stakeholder analysis could be simple or complex matrices, depending on the

objective of the analysis. The legitimacy, roles, influence and urgency of stakeholder affect decision making in FRM.

Several methods can be used for stakeholder analysis, depending on the objective of the research project, and each method determines who and what really counts in the analysis (Mitchell *et al*., 1997, 2011). Who refers to the organisations, group of individuals and individual actors while what stands for the stake of the stakeholder or the management of a development on which the stakeholders have an influence. The focus is to identify the broad range of stakeholders as basis for categorising and analysing the key stakeholders of FRM.

Reed *et al.* (2009: 1937) explain various methods for stakeholder analysis and relevant sources of data for such purposes. Each of these methods has its pros and cons. Therefore, a mixed methods approach is recommended for qualitative stakeholder analysis. The qualitative approach is descriptive, by which the researcher, together with the research participants, who are the potential stakeholders, collectively identify and categories the stakeholders with their respective attributes (Hare & Pahl-Wostl, 2002: 59; Reed *et al*., 2009). In conduction of this research, documents analysis, semi-structured interviews, and stakeholder analysis and validation workshop are employed for the data gathering.

The document analysis and semi-structured interviews, as well as key stakeholder validation workshop appear more of top-down than bottom-up approaches to stakeholder analysis (SA) (Reed *et al*., 2009). Thus, the stakeholder validation workshop was employed through a focus group discussion to engage the research participants and the researcher in order to reduce biases. Other scholars in the field of SA also used this approach, and it was considered suitable for this study (Reed *et al*., 2009; Chevalier & Buckle, 2008; Nash *et al*., 2005). These methods are however, prioritised over the other methods because they are more appropriate for the objectives of this study.

Literature refers to several methods for stakeholder identification and categorisation. Methods such as cards, stakeholder matrix, Venn diagram, rainbow and flip charts have been applied for identification and categorisation. Chevalier & Buckle (2008) aptly applied rainbow figure to categorise stakeholders of FRM in a community in Nepal as in Figure 2 below. Reed *et al.* (2009) recommended this strategy for

stakeholder analysis. The rainbow approach has a potential to produce stakeholders who can affect or be affected by an action. It is helpful for results depicting broad groups of stakeholders, but does not offer details on specific key stakeholders and their attributes.

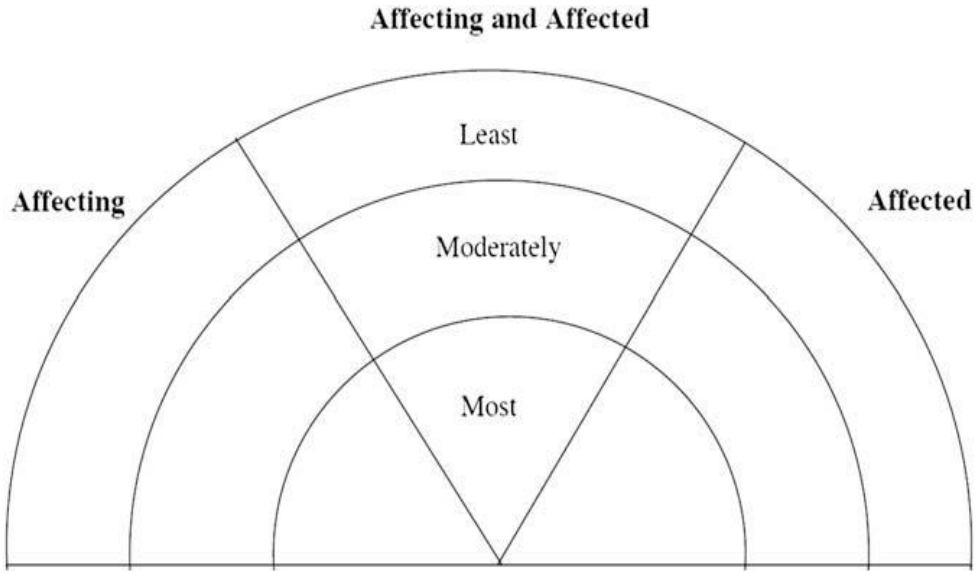

Figure 2: Rainbow diagram of stakeholder classification

Source: Chevalier & Buckles (2008)

The Rainbow diagram qualitatively categorises the stakeholders according to the degree to which they can affect or be affected by a problem or action, as Chevalier & Buckles (2008) explain. This classification focuses on stakeholder participatory and social analysis. Similarly, Mitchell *et al*. (1997: 872) differentiate various classes of stakeholders based on possession of one or more of the three attributes of power, legitimacy and urgency, as in the Figure 3.

Mitchell *et al.* (1997) applied power, legitimacy and urgency as stakeholder attributes to classify stakeholder salience in the management of organisations. Schmeer (1999) uses the Venn diagram to identify and display stakeholders based on their roles, influence and interest. In this research, matrices of columns and rows are applied for the stakeholder analysis. These matrices provide room to present the stakeholders and their attributes.

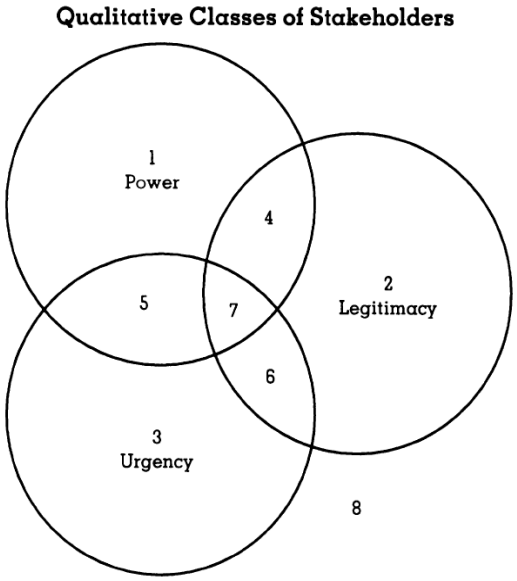

Figure 3: Stakeholder classification based on power, legitimacy and urgency

Source: Mitchell *et al.* (1997: 872)

Analytical and reconstructive categorisation approaches were applied for stakeholder analysis in FRM in the city of Accra. This approach provides an opportunity for potential stakeholders (research participants) to participate in identifying the keys stakeholders of FRM (Hare & Pahl-Wostl, 2002; Reed *et al*., 2009)**.** In analytical categorisation, final lists of stakeholders are produced by the researcher through analysis of data obtained from interviews and secondary sources. Reed *et al*. (2009: 1939) argue that analytical categorisation has low quality because the approach tends to emphasise the usual suspects and ignores or underrepresents marginalised stakeholders. This also means the suspects who may be extinct, and newly introduced stakeholders may be ignored. Similarly, Schmeer (1999) explains that the number of stakeholders and their characteristics change over time. In other words, the number of stakeholders in public management is not static and changes with time. Some stakeholder groups may fallout while new ones may join the management team in the future. The combination of document analysis, interviews and focus group discussion (i.e. stakeholder validation workshop) in this research was meant to reduce possibility of such bias.

Reconstructive categorisation is more interactive and bottom-up to the stakeholder analyst and research participants to define and categorise final list of stakeholders. It

gives opportunity to stakeholders themselves to do the analysis, by identifying and categorising stakeholders using key words (phrases) of stakeholder attributes (Reed *et al*., 2009). Expert interviews and stakeholder validation workshop through focus group discussion are relevant for the reconstructive categorisation approach (Hare & Pahl-Wostl, 2002; Reed *et al*., 2009).

The analytical approach has been widely applied to define the principled stakeholders into broad categories, classifying groups of stakeholders. From a generic understanding of the stakeholder concept, Chevalier & Buckles (2008) use this approach to define stakeholders of FRM to include individuals and organisations in communities. In the same vein, Freeman (1984) categorises stakeholders of business organisations into groups of cooperation and competition. Mitchell *et al*. (1997) identified salient stakeholders as those groups and individuals who have two or three of the attributes of power, legitimacy and urgency to influence decision making of management. Moreover, stakeholder analysis by De Lopez (2001) also generates groups of key players, context setters and subjects (cited in Reed *et al*. 2009: 1938). Schmeer (1998) also uses this approach to identify stakeholder influence in terms of interest, influence and roles in policy design and implementation. These attributes are relevant to stakeholders and listed in matrices or Venn diagram.

Stakeholders in FRM can be broadly categorised into public and private sector organisations (Schmeer, 1999). These organisations may have international, national, district and local community origin but directly involved in FRM. External stakeholders account for international actors who affect FRM at local and national levels. FRM attracts local, national and international organisations as well as private sector organisations (Schmeer, 1999). Stakeholder identification and categorisation also refer to attributes such as stakeholder interrelationships (Schmeer, 1999). Legal claims of claims in FRM also specify individuals and organisations who hold stakes. Legal claims refer to laws and customary regulations.

Stakeholders as actors representing organisations can also form alliance by coordinating with other stakeholders in FRM. Relationship in terms of stakeholder interest in FRM can be supportive, cooperative, opposition, or conflicting. An actor may not have the power to influence a project individually but could influence a project by forming alliance with other stakeholders for a common interest in a project.

Influence comes from the use of resource - human, financial, logistics, technical, political and alliance of organisation to inspire decision-making and implementation of strategies.

SA encapsulates systematic gathering and analysis of information on actors in order to determine whose legitimacy, role, influence and urgency should be taken into consideration in development and implementation of new policies, programmes or initiatives. The influence or impact of a stakeholder can be positive, negative or neutral. Therefore, SA considers the attributes of a stakeholder in relation with success or failure of the development and implementation of management policies, programmes or initiatives. It can be deduced that stakeholder analysis depends on the objectives of the research being conducted and which can make it normative.

For the objective of research question 1 of this thesis, a linear stakeholder analysis approach is employed to identify the key stakeholders of FRM. The main attributes for the identification of the key stakeholders are the legitimacy, roles (responsibilities and tasks), influence and urgency. The analysis refers to those attributes of stakeholders of FRM of the study site to classify them as the key stakeholders. The focus of the analysis is not on the individual citizens of the study site, but on organisations in FRM.

Four steps are considered in the approach to answer the research question 1:

- Step 1 involves a review of literature on stakeholder concept to identify principled stakeholders in FRM.
- Step 2 focuses on identification of stakeholder attributes of legitimacy, role, influence and urgency for the analysis of stakeholders in FRM.
- Step 3 focuses on identification of potential key stakeholders of FRM in the city of Accra from analysis of documents and expert interviews on the basis of the attributes in the Step 2.
- Step 4 is the determination of the final list of key stakeholders of FRM in the city of Accra from a stakeholder validation workshop through group discussion on the basis of the attributes in the Step 2.

These steps are elaborated in the following.

Step 1: Review of literature on stakeholder concept to identify principled stakeholders in FRM

A review of generic literature on the theory of stakeholder analysis and FRM, as well as specific literature on the FRM system in the study site was undertaken. The generic literature provides conceptual basis for defining a scope for stakeholders in FRM, whilst the specific literature helps to define stakeholders for the specific FRM system of the research. On this basis, a wide scope of stakeholders who are affected by flood risk, and also affect FRM in Accra can be mapped. This understanding resulted categorisation of several public, private and civil society organisations, as well as individuals as stakeholders in FRM in the study site. Flood disaster risk affects public, private and individual properties. Activities of these stakeholders can also determine the fate of flood risks in society. Stakeholders possess attributes of local, national, regional and international statuses.

International organisations play a major role in disaster risk management, in terms of financial, technical and policy support for developing countries. For instance, The World Bank (2009: 6) acknowledges that "in the disaster-prone countries, The World Bank often plays a role in coordinating humanitarian donor efforts both ex-ante and ex-post assistance for reconstruction and recovery." The United Nations International Strategy for Disaster Reduction (UNISDR), The Secretariat of African Caribbean and Pacific Group of States (ACP), the International Federation of Red Cross and Red Crescent (IFRC), the European Union (EU) are also mentioned as strong actors in risk management.

The work of the World Meteorological Organisation (WMO, 2007) on guidance for flash flood management in the Eastern Europe acknowledges that, floods can affect everyone, including mayors, central administrative units at regional and national local levels, as well as the non-governmental organisations, private companies and individuals who may influence FRM through a legal framework. It is further noted that "…flood management involves the competencies of several government departments, such as the Ministry of Environment, the Ministry of Internal Affairs, and the Ministry of Construction or Transport. Thus, the clear definition of roles of various institutions participating in this process at various levels of management is a task which cannot be overestimated" (WMO, 2007: 48). The meteorological and hydrological services departments are distinguished as key players of FRM in the

areas of hydrological and weather observations for flood forecasting and early warning information.

Types of government institutions that play a role in FRM comprise international, regional, national and local government administrative units at the metropolitan, municipal, district assemblies (MMDAs). Broadly, a list of stakeholders in disaster risk management is derived and grouped into three main categories; public sector, private sector, and civil society sector actors. The public sector actors are furthered divided into international, state and local government organisations or agencies. The private actors encompass companies or for-profit organisations such as financial bodies, waste management and insurance companies. The civil society actors include Non-governmental organisations (NGOs), both local and international that play a role in FRM.

Also, individuals at community levels are primarily affected by floods directly and indirectly, so they also play roles in dealing with floods at the household and community levels. In the developing world particularly, relatives and friends support each other in such situations, especially during the emergency so they can be regarded as stakeholders at this level. Individuals who also offer special help, such as donations for drainage projects or who have developments on waterways also influence FRM in cities. FRM instruments are also influenced by local individuals as they could stifle or facilitate implementation of such measures. Although these groups are stakeholders of FRM, they are not all considered key at decision making level in FRM strategies. Thus, there is need for the further steps to answer this research question.

Step 2: Identification of stakeholder attributes of legitimacy, role, influence and urgency for the identification and validation of stakeholders of FRM in city of Accra

The set of indicative criteria for identifying who is a key stakeholder in FRM of Accra is derived by the notions of FRM concept, objective of the study and concept of stakeholder analysis. The focus is on key stakeholders in FRM in the city of Accra.

Concept of stakeholder in organisational management includes individuals and organisations who are involved in management activities (Freeman, 1984; Schuman, 1995; Mitchell *et al*., 1997). Bryson (2004: 26) argues that “at a minimum, stakeholder analyses should help public managers figure out who are the key and

what will satisfy them." Bryson considers key stakeholders as those whose contributions are important for functions and activities of management strategies. Identification and validation of key stakeholders in organisational management is a form of stakeholder analysis and requires a set of criteria to allow the researcher to categorise the stakeholders (Mitchell *et al*., 1997; Bryson, 2004; Fottler *et al*., 1989). Criteria for stakeholder identification and categorisation can apply various attributes of stakeholders of organisational management (Bryson, 2004; Stone, 1997). For instance, Bryson (2004) and Mitchell *et al*. (1997) apply elements of power, legitimacy, and urgency as attributes for identification and analysis of stakeholder salience in management of business organisations. These three features are used to describing who is and who is not a key stakeholder. These attributes help to define who and what really counts in stakeholder identification and salience. Fottler *et al.* (1989) contend that identification of key stakeholders is crucial for hospital management, with an explanation that key stakeholders are influential and powerful controllers of hospital resources and operations. A key stakeholder is that context refers the power of resources and core values to affect management of hospitals.

In this study, the identification of potential key stakeholders in FRM is based on legitimacy, role, influence and urgency as attributes of stakeholders (Schulman, 1995; Mitchell *et al.,* 1997; Bryson, 2004). This research does not treat power as separate attribute of stakeholders as it overlaps with legitimacy, role, influence and urgency. Power as an attribute also focuses much more on actors than organisations. For instance, power is understood as "the probability that one actor within a social relationship would be in a position to carry out his own will despite resistance" (Weber, 1947 cited in Mitchell *et al*., 1997:865). Similarly, in the words of Pfeffer (1981: 3), power is "a relationship among social actors in which one social actor, A, can get another social actor, B, to do something that B would not otherwise have done". This makes power much of actor bias, with emphasis on single organisational management rather than management in realm involving multiple organisations in their own right. Power as stakeholder attribute is also characterised by force and control, which are hard to measure in public management involving multiple organisations of equal standing. On this basis, power is treated as a main subject of stakeholder attribute. In management of public realm, power can take its sources from legitimacy, role, influence and urgency.

Legitimacy is considered as an attribute for identifying potential key stakeholders of FRM in the city of Accra. Scholars without common precision and consistency (Schumann, 1995; Phillips, 2003) apply the concept of legitimacy in stakeholder analysis broadly or narrowly. For instance, Schuman (1995: 574) understands legitimacy broadly as “a generalised perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions.” This means organisations are individually created, but are legitimated entities with shared beliefs of the general societal system. It is objectively possessed and garners support from the collective audience (Schumann, 1995). Legitimacy also implies "congruence between the social values associated with or implied by [organizational] activities and the norms of acceptable behaviour in the larger social system" (Dowling & Pfeffer, 1975: 122, also see Parsons, 1960; Scott, 1991; Schumann 1995). This assertion also affirms that the organisations have the right to exist and their activities are generally accepted in the social environment they operate.

Scholars also describe legitimacy into detail looking at different types such as pragmatic, moral and cognitive forms legitimacy (Suchmann, 1995; Mitchell *et al*., 1997; Philips, 2003). These details are however, outside the scope of this research. The attribute of stakeholder legitimacy is described in terms of the legal and social recognition of the organisations and their acceptance in the FRM operations by the other organisations involved in FRM in the city of Accra. This understanding captures elements of pragmatic and moral realities of legitimacy, which fit into Phillips (2003: 30-31) categories of normative and derived forms legitimacy. Organisations with legitimate roles or responsibilities for FRM also count. Legitimacy may have different connotations but in FRM stakeholder context, a consideration is given to actors who have a legal/formal responsibility for performing certain tasks toward FRM in Accra (WMO, 2007; Futaki, 2010). This legitimacy is not limited to legitimate local actors but it considers external actors who have interest and legitimate roles towards FRM. Legitimacy in this research is considered in terms of legal recognition of the organisations. This legal recognition is important as it serves as a source of power of organisations to perform any roles in FRM.

Role in FRM is another attribute for key stakeholders. Role also implies a stake in management. Mitchell *et al*. (1997: 859) consider "stake," identifying salience

stakeholders in terms of groups with “a legal, moral, or presumed claim on the firm and groups that have an ability to influence the firm's behaviour, direction, process, or outcomes” and concludes both count. Laws and regulations therefore mandate roles. Fottler *et al*. (1989) map out key hospital stakeholders, among other attributes, on the basis of their authority to play roles in the delivery of certain services and provide funds for operations of the hospital. Roles in this research refer to responsibilities of the organisations for FRM. Roles may cut across activities of organisations to exert an influence in FRM.

Influence was applied as attribute of key stakeholders in FRM. Fottler *et al*. (1989) consider influence in the identification of hospital key stakeholders in terms their ability to control or regulate the use of hospital financial, material and human resources as well as other stakeholders including patients in their choices of which hospital to attend or not to attend. Influence is applied in this research to describe the effect of roles of stakeholders on a specific phase of FRM. This goes to point out the actual effect of the role of the organisations on the pre-flood, emergency flood and post-FRM. The roles played by key stakeholder organisation to attract the attention of fellow organisations and society. This attention may be due to positive or negative influence that particular organisation imparted on FRM. This leads to the attribute of urgency of key stakeholders in FRM in the discussion.

Urgency is also key parameter for defining a key stakeholder. Mitchell *et al*. (1997: 867) define “urgency as the degree to which stakeholder claims call for immediate attention”. This definition is in the context of business management of firms. This is state where stake, role or claim of stakeholder in the management is considered pressing, time sensitive and compelling. This means delay in the receiving deliverables from such a stakeholder can disrupt management success. In FRM, for instances, failure to deliver relief items, provide drains or mapping out of flood risk may lead to inability to reduce flood risk during flood event. Urgency implies the attention that a stakeholder gets from other stakeholders and the public in the management of flood risk in the city of Accra. This research then identifies and describes key stakeholders using their attributes of legitimacy, roles, influence and urgency in FRM.

Step 3: Identification of potential key stakeholders of FRM in the city of Accra from analysis of documents and expert interviews on the basis of the attributes in the Step 2.

In Step 3, relevant documents were reviewed to identify potential key stakeholders of FRM. Scott (1990) argues that documents as a source of data give historical information about the phenomena been researched; this information is about antecedents that do not exist in oral form. Documents can however, be overwhelming and it is important to sieve them to get the most relevant ones that can be handled. Accordingly, Scott (1990) outlines factors that help to determine relevant documents for research work. The first point is; to consider the authenticity of the document. The source and authorship documents for identifying stakeholders were considered in this research. The researcher considers creditable official documents as those from international, national, district, private sector and local community organisations of FRM in Accra (Ghana). Soundness of facts and terms relevant to FRM is also important. Original documents or copies of such documents from the main institutions are also essential. The source of the document is important because it determines the quality of the data. Moreover, the contents of the documents to be used are also considered facts about organisations of FRM in the city of Accra. Potential challenges of using documents (historical data) include misfiling, accidents, and lack of information (reference) of these documents (Scott, 1990). Documents on FRM management were useful for identifying the key stakeholders of FRM in the city of Accra. The Accra Metropolitan Disaster Management Plan (NADMO, 2010), the National Contingency Plan (NADMO, 2010) and the National Disaster Management Standard Procedures (NADMO, 2010). Annual reports on flood risk and flood disasters in Accra (NADMO, 2007, 2009, 2010, 2011, 2012), as well as minutes of the Accra Metropolitan Disaster Management Committee of 2013 also offered important source of data for potential key stakeholders of FRM.

Personal consultations with the officers can help to deal with challenges, gaps and inconsistent information in the document being analysed for the potential key stakeholders in FRM. To compensate for these gaps, personal consultations and interviews with individual representatives of organisations in FRM for current information were made. Basic questions about roles of the stakeholders in FRM in

Accra were asked. For instance, does your organisation play a role in managing flood risk in the city of Accra? What other organisations play key roles in FRM in the city of Accra? Analysis of documents and the interviews produced potential key stakeholders in FRM, and described against the attributes defined in the Step 2.

Step 4: Determination of the final list of key stakeholders of FRM in the city of Accra from a stakeholder validation workshop through group discussion on the basis of the attributes in the Step 2.

Final stage for deriving key stakeholders applies stakeholder validation workshop through focus group discussion to confirm the list of key stakeholders in FRM in Accra. The stakeholder attributes were crosschecked against each stakeholder in FRM for confirmation or rejection in the final list. Stakeholders who possess these four attributes constitute key stakeholders. The research acknowledges that this consideration is normative, since stakeholders with elements describing at least two attributes can form alliance to affect FRM. However, this approach to selection of the key stakeholders was the logically consistent. The stakeholder validation workshop discusses the attributes and assigns them against the stakeholders in the list developed from the document analysis and interviews. Finally, profiles of the key stakeholders are analysed. The empirical evidence from the interviews and the stakeholder analysis workshop are used for this descriptive analysis, as discussed in the next section.

In stakeholder analysis, the issue of stakeholder group boundaries is regarded as tricky and difficulty to define. As Chevalier & Buckles (2008) argue, this issue raises questions about when to separate stakeholders into various groups and when lump them into a single group, as well as when to recognise the community of all stakeholders. The researcher recognises that the description of the legitimacy, roles, influence, urgency and other attributes of key stakeholders in FRM for the different levels of the study site overlap as stakeholders may play similar roles across different levels of government with legitimacy, influence and urgency. Thus, the description of such attributes in this research is a summary of stakeholder responsibilities in FRM and need not be restricted to specific levels of the organisations. There are no strict levels in these descriptions. Each organisation has its own legitimacy, role, influence and urgency in the management of flood risk and impacts. In emergency FRM operations, these attributes could crisscross.

3.4.2 Research question 2: Semi-structured interviews and content analysis

Semi-structure interviews

The research question 2 was exploratory and mainly sought pieces of information about aspects and indicators of resilience in the FRM strategies. The exploratory strategy allowed the researcher to obtain as much relevant data as possible. The objective is to analyse the capacities of the FRM strategies for responding to the unexpected course of flood disasters. In addition, the exploratory strategy also obtained data on the characteristics of anticipation in FRM strategies. Data on the characteristics of anticipation are also relevant for describing features of expected flood risk and impacts.

Face-to-face individual expert interviewing method was employed to obtain qualitative data to answer the research question 2. This method provided comprehensive descriptive data for answering the research question. The approach provided relevant data to explain how the key stakeholders in FRM deal with the unexpected course of flood disasters in addition to the expected features of flood risk and impacts in their management strategies. The data also offered an opportunity to understand the FRM strategies and analyse the aspects of resilience in them. The treatment of the unexpected course of flood disasters by the key stakeholders captures the aspects of resilience in their FRM strategies. Data were obtained from semi-structured interviews with heads or their representatives of organisations**.** Details about expert interviews have already been discussed in this chapter.

Content Analysis

Content analysis is a relevant method for analysing qualitative data. The data are maintained as words for description and interpretation of resilience. In this study, the framework for operationalisation of resilience in FRM strategies provides a defined structure and themes for coding, sorting and categorising the data. The research participants used key words that refer to the aspects, indicators or the identifiers in the interviews, and coding was done by searching the data for those key words and assigning them to the specific aspects of resilience and anticipation as they are found. These coding themes, refer to the aspects of resilience and anticipation in FRM strategies defined in Tables 1 and 2. Each interview transcripts is read repeatedly and relevant words and portions of the text that refer to the specific

aspects, indicators and identifiers of resilience and anticipation are coded (Crang and Cook, 2007). Codes from specific interviewees are identified by abbreviations as pseudonyms to ensure the anonymity of the research participants. These pseudonyms allow to sort the data according to the categories of the organisations in FRM.

The interview questions were designed into specific sections with themes that refer to the aspects and indicators of resilience and anticipation to make the coding pragmatic. Each indicator is a theme for coding and categorising the data. The aspects of anticipation in FRM strategies mainly describe the response capacity of the strategies for dealing with determined (anticipated) flood risk. The table is a lens for sieving relevant data from the interviews and the analysis.

The Microsoft Word assisted in the coding of the data by using word search and to find and highlight words and portions of the text that are relevant for the analysis. This strategy was relevant because interviews were conducted by the researcher and easy to coordinate. The number of interviews was sufficient and could be managed by find and features in the Microsoft word features.

The empirical results on the aspects of resilience and anticipation in the FRM strategies are presented in separate sections. This grouping provides opportunity to identify strengths and weaknesses in the FRM strategies of the key stakeholders in the city against the aspects for describing resilience in FRM strategies as indicated in Table 1 of this research. Strategies to improve the aspects and indicators of resilience and anticipation in FRM were sought. Based on these data on the aspects and indicators of resilience of FRM strategies, hypotheses are derived.

Interpretation of the data refers the codes to the specific aspects of resilience and anticipation. The researcher interprets the data regarding the aspects and indicators of resilience in FRM strategies. The interpretation reflects on the weaknesses in the response capacities for dealing with unexpected course of flood risk and flood impacts. The critical attention was on the strategies for dealing with undetermined flood risk as the underlying course of unexpected flood disasters. The determined risk is associated with anticipation in FRM strategies while the undetermined flood risk is concerned with resilience in FRM strategies (also see Section 2.2.2 for details on the two kinds of risks).

3.4.3 Research question 3: Derivation of hypotheses

Section 3.4.3 focuses on the approach to hypothesis formulation from the empirical findings of this thesis. The main approach to answering the research question 3 is the inductive hypothesis derivation technique. General inductive hypothesis can results in development of a theory. However, development of a theory is not the direct result of the inductive approach in this research but its meaning in the application of the resilience in FRM strategies. These hypotheses are evidence-based statements or questions about advancing the capacity of the key stakeholders for responding to the unexpected course of flood disasters in addition to the expected features of flood risk. The hypotheses are derived from the empirical findings with reflections of the aspects and indicators of resilience and anticipation in their operationalisation.

The first ideas of the hypotheses are taken from the aspects and indicators of resilience and anticipation as in the operationalisation of the concept in this thesis. The aspects and indicators constitute the conceptual basis of the hypothesis. Relevant findings on each aspects of resilience are used as evidence to construct specific propositions. Results of the analysis give directions to formulate propositions for resilience of FRM strategies in Accra and other cities with similar environment. The hypotheses are required to be tested through future research, which is outside the focus of this study. A potential approach on how these hypotheses could be tested is however discussed in this section.

Characterisation of hypothesis

A hypothesis is basis or outcome of a scientific work. Kumekpor (2002) explains that research that begins with hypothesis has a strong theoretical foundation and rich background information for investigation. In contrast, research that has no solid theoretical basis for the topic of investigation results in development of hypotheses.

Qualitative research, unlike quantitative study, does not usually aim at testing hypotheses. Rather, qualitative research can generate hypotheses to stimulate future research for conceptual improvement (Bryson & Crosby, 1997). Auerbach &d Silverstein (2003: 8) explain that “qualitative hypothesis-generating research involves collecting interview data from research participants concerning a phenomenon of interest and then using what they say to develop hypotheses.” Kumekpor (2002: 59-

60) argues that " a hypothesis may be conceived as a suggested answer to a problem or an assumption made by a researcher to provide him with a guide to the problem he intends to investigate as well as providing him with a restricted focus to direct his attention in the observation stage of his research." A hypothesis can therefore be considered as a reasonable guess, assumed statement based on scientific findings or evidence. Hypothesis outlines a relationship between dependent and independent variables that can be simple or complex (Prasad, 2013). Similarly, the hypotheses in this research draw e relationships of resilience in FRM strategies.

A hypothesis has basic characteristics that distinguish it from other statements and are important to discuss. Unlike everyday guesses and predictions of ordinary life, a hypothesis has scientific characteristics that inspire its derivation and testing. One characteristic of hypothesis is its relationship with theory, propositions, variables and empirical findings about a phenomenon that has been investigated (Ahamefula, 2012). This relation is worth mentioning as it facilitates the focus and contribution of this chapter to this research. Bacharach (1989: 498) understands hypothesis "as a statement of relationships between units observed or approximated in the empirical world." Bacharach (1989) further explains that "a theory may be viewed as a system of constructs and variables where the constructs are related to each other by propositions and the variables are related to each other by hypotheses" (also see Nagel, 1961; Dubin, 1969; Cohen, 1980).

Constructs are approximated units that naturally cannot be observed directly while observed units (variables) can be empirically operationalised through measurement (Bacharach, 1989). Constructs are therefore theoretical aspects of hypothesis. Variables are observable (measurable) indicators of these theoretical aspects. Kaplan (1964: 55) understands constructs as "terms which though are not observational either directly or indirectly, they may be applied or even defined on the basis or the observables" cited in Bacharach (1989: 500). In other words, constructs are a broad mental configuration of a given phenomenon being studied. Constructs can, therefore, be seen as concepts constituting a conceptual framework that are observed and operationalised by specific indicators. In this research, constructs can be situated in the position of the notion of resilience in the applied framework. This

explanation connotes that hypotheses are derived from propositions consisting of theoretical units of construct and variables.

Propositions are statements that explain the interrelationships between constructs and variables. From these declarations, hypotheses can be derived from more specific, concrete statements guiding future work. Hypothesis demonstrates the relationships among variables that make measurements and testing possible. On the other hand, variables manifest theoretical constructs to real life experiences. Bacharach (1989) argues that "theoretical systems take the form of propositions and propositions-derived hypotheses." Proposition and hypothesis are statements of relations. While the former is more abstract, the latter is concrete and operational declarations of the broad relationships, and develops from specific variables (Bacharach, 1989). It is therefore plausible to argue that in the development of the hypotheses in this chapter, propositions become a fundamental recipe spiced with relevant quotations of the empirical findings. The next section discusses the basic requirements for formulation of hypothesis.

Requirements of hypothesis

There are scientific requirements for hypothesis. The requirements qualify hypothesis to be tested scientifically. These features are important and need to be discussed. A common feature of a hypothesis is its general guess or assumption of interrelationships of a real world phenomenon. A hypothesis requires a characteristic of generalisation in such a way that, it can be applied beyond a single event of real world. A statement that goes beyond a single event of study can be verified for confirmation and falsification of other events of its kind. Moreover, a hypothesis requires a formal structure that shows the direction and results of the interrelationships of the variables. Hereby, hypotheses describe research findings on shortcomings of resilience in FRM strategies and address the potential for advancement.

Hypothesis further needs to demarcate boundary conditions within which it is derived. These boundary conditions are layout features of the real problem that is being investigated. These conditions limit the hypothesis to a specific focus and make it operational. For a hypothesis to be operational, it needs to be assigned to real phenomena. In this research, for instance, FRM strategies are a real

phenomenon. Moreover, the key stakeholders in FRM in the same context also exist in practical world. This feature of operationality creates opportunities for researchers to be able test hypothesis.

Thus, a hypothesis is fundamentally testable. This character makes hypothesis scientifically possible to reject or verify. This testability enables researchers to prove the assumed interrelationships of the theoretical constructs using variables indicators of the empirical features of a real world phenomenon being researched. A variable implies “an operational configuration derived from a construct and has two or more values” (Bacharach, 1989: 498). These together are building blocks for a conceptual framework.

In other words, a good hypothesis sounds logical (showing interrelationships) with empirical adequacy (showing the applied capacity of the hypothesis) to enable it to be operationalised (Bacharach, 1989). Logical relevance implies that a hypothesis ought to provide testing opportunity to reject (falsify) or confirm it. An assumption that sounds illogical with a clear statement containing dependent and independent variables may be hard to operationalise. The testing of hypothesis therefore, applies theoretical statements to a real world phenomenon. Constructs with propositions are derived logically whereas variables with hypothesis are derived empirically. The logical and empirical characteristics of hypothesis make it possible to have different types of hypothesis.

Types of hypothesis

The logic of the interrelationships or differences of constructs of a proposition could yield a directional or non-directional hypothesis. A directional hypothesis states the relationships of variables with a clear direction of their effect, influence or outcome of the interrelationships. A directional hypothesis explicitly states the absence or presence of variables, their interrelationships and resultant effects as positive or negative. On the other hand, non-direction hypotheses do not explicitly indicate the outcome of the relations but the relationship of the variables. This form of the hypothesis is not explicit about a particular issue of the relationship between the variables; what is clear is that there is a relation between or among stated variables. Directional and non-directional hypotheses also sound declarative as they clearly

spell out a causal effect of absence or presence of variables. In some cases, a hypothesis could be in a form of a question.

The forms of scientific explanation statement include a directional or non-directional and a questioning hypothesis. A null or an alternative hypothesis is useful for statistically testing to reject or confirm a hypothesis. In this research, the hypotheses are mainly directional. Hypotheses are directional because they are statements pointing a way forward for advancing resilience in the formulation and implementing FRM strategies of key stakeholders in particular and similar cities in general terms.

Approaches to hypothesis

Hypothesis is a foundation for scientific progress and can contribute to science through deductive and inductive approaches. From this perspective, Kell & Oliver (2003: 99) argue that "generation and testing of hypotheses are widely considered to be a primary method by which science progresses." The point here is that hypothesis is a fundamental component of scientific work, and it can be a starting point where it is deductively designed from existing evidence or a main outcome of a research through an inductive approach. A deductive hypothesis design becomes feasible where a prior theoretical knowledge about a phenomenon under investigation is available and becomes a basis for developing a hypothesis to be empirically tested by the researcher. A set of scientific literature with theoretical basis or results of an empirical work are the major sources of knowledge for deriving a hypothesis leading to development or extension of a theory.

In this study, the derivation of the hypotheses is structured and guided by the framework for operationalisation resilience in FRM strategies. Aspects of resilience and anticipation become the conceptual lenses for interpreting the findings. As Bacharach (1989: 496) describes conceptual framework as "a linguistic device used to organise" volume of data obtained from empirical world.

In this research, the derivation of the hypotheses is guided by the framework for the operationalisation of resilience in FRM strategies as shown in Table 1. Aspects of resilience in the context are conceptual lenses for interpreting the findings. As Bacharach (1989: 496) describes conceptual framework as "a linguistic device used to organise" volume of data obtained from empirical world. As demonstrated in the next section, each aspect of the framework is hypothetically analysed with evidence,

pointing out its effects on resilience in FRM strategies. Additionally, the hypotheses also consider aspects of anticipation in FRM strategies as Table 2 demonstrates. Table 2 focuses on strategies for dealing with expected features of flood risk but forms a platform from which aspects of resilience in FRM strategies can evolve. Analysis of the propositions uses empirical reasons to demonstrate each aspect of resilience and anticipation in the conceptual framework of the thesis. The level of this consideration shown by the empirical findings leads to the derivation of the hypotheses. The forms of scientific explanation statement include a directional or non-directional and a questioning hypothesis. For testing statistically to reject or confirm a hypothesis, stating a null or alternative hypothesis makes sense. In this research, the hypotheses are mainly directional. Hypotheses are directional because they are statements of ways forward to advancements of the aspects of resilience in FRM strategies of key stakeholders in general terms.

In summary, this chapter covers the research design and methods for this study. The overall design and specific methods for the answering the research questions are addressed. Techniques for the research design and sampling as well as the data analysis strategies are discussed. The next chapter is the results on the research question 1.

4 Identification of potential key stakeholders and selection of key stakeholders

This chapter presents findings on identification and selection of key stakeholders of FRM in the city of Accra. The results are presented following the procedure for stakeholder identification in Chapter 3. First, principled stakeholders are identified based on literature review on stakeholder concept following step 1 in Section 3.4.1. Second, potential key stakeholders of FRM in Accra are presented as findings from analysis of documents and interviews following step 3 in Section 3.4.1. Third, a final list of key stakeholders in FRM is presented based on stakeholder validation workshop following step 4, Section 3.4.1. The key stakeholders are described using the four attributes of legitimacy, role, influence and urgency defined in step 2, Section 3.4.1.

4.1 Principled stakeholders of flood risk management

In this section, results of Step 1 of Section 3.4.2 are presented. Literature on stakeholder theory suggests that individuals, groups and organisations can affect or be affected by organisational management (Freeman, 1984; Bryson, 2004; Chevalier & Buckles, 2008; Reed *et al*., 2009). In the context of FRM, societal process of analysis, evaluation and reduction of flood risk involve individuals, groups, communities and organisations (Schanze, 2009; Sempijja, 2013). In principle, the involvement of individuals, groups, communities and organisations in the tasks of FRM process can qualify them as basic or principled stakeholders. Table 4 displays the principled stakeholders in FRM.

Individuals refer to residents and non-residents who can affect or be affected by floods. Flood hazard analysis accounts for impacts of floods on individuals and their properties. Hence, experiences of individuals can contribute to flood hazard analysis. Flood vulnerability analysis also involves individuals in the process of quantifying and understanding potential adverse social, economic and ecological impacts of floods, depending on the value, susceptibility, coping capacity and lessons learned (Blanco-Vogt & Schanze, 2014). Exposure of persons and properties to floods is included in flood risk analysis. Risk determination includes nature and extent of flood risk and may involve individuals as the affected persons or experts. Flood risk analysis can

result in flood risk maps or reports. Maps contain information about individuals and properties in flood-prone areas. Individuals are considered as principled stakeholders because they are affected by floods and are included in the analysis, evaluation and reduction of flood risk. Moreover, individuals affect flood risk. Organisations are also principled stakeholders because they can be affected by flood risk and they can, in turn, affect flood risk. In fact, organisations participate in FRM. International, national, regional and district level organisations take part in analysis, evaluation and reduction of flood risk.

Table 3 Principled stakeholders of FRM

Principled stakeholders of FRM		
Individuals	**Groups/communities**	**Organisations**
• Residents • Non-residents	• Local Communities affected by floods (families, community leaders, landowners, groups, opinion leaders, politicians)	• International organisations (NGOs and Development partners) • National organisations • Regional organisations • District organisations • Local (Civil society and community based organisations) • Traditional authorities (chiefs, land owners) • Business organisations (Engineering companies, flood insurance companies, mortgage companies)

Source: Adapted from Freeman (1984); Chevalier & Buckles (2008); Schanze (2009); Sempijja (2013).

Research institutes and universities, as well as civil society and community-based organisations may participate in analysis of flood risk as researchers or individuals and organisations that are affected by floods. Evaluation of flood risk is also a societal process in which individuals, groups, as well as organisations are involved as principled stakeholders. Risk evaluation can be applied as judgement of individuals, groups or organisations on flood risk depending on values, aims and interest. Evaluation of flood vulnerability may account for demographic, social, economic and environmental conditions of flood-prone areas as well as perception and attitudes of people towards flood risk. Individuals, flood-prone communities, and organisations are, therefore, part of vulnerability evaluation as stakeholders. Individuals, groups and organisations also monitor and evaluate FRM alternatives.

Individuals, groups and organisations can affect FRM. Individuals, groups or organisations affected by floods may undertake initiatives for FRM. These initiatives can be short and long-term measures, such as pre-flood, flood event and post-flood event management. Initiatives may be motivated by personal values or public regulations related to flood risk. Personal initiatives, for instance, can include flood proofing measures, insurance, building on safe grounds and abiding by land-use regulations. In addition, individuals, families and groups in communities may volunteer to help reduce flood risk and flood impacts. Land-use practices in flood-prone communities can reduce or intensify flood risk. Flood-prone communities may provide support for victims of floods through relief and shelter. Organisations can also be responsible for preparing and implementing FRM measures. Some organisations voluntarily participate in this process. International organisations provide financial and technical support for national, regional and district organisations for FRM. Individuals and communities affected by floods also receive humanitarian support from international organisations. National organisations have responsibility to prepare and implement FRM plans. It is the responsibility of the state organisations from national, regional to district levels to provide the needed infrastructure for FRM.

Derivation of principled stakeholders of FRM follows the basic meaning of stakeholder concept. Principled stakeholders in FRM, therefore, include individuals, groups/communities and organisations. Empirical investigation towards selection of

key stakeholders in this study focuses only on organisations involved in FRM and does not include individuals. Organisations as principled stakeholder may be international, national and district as well as non-governmental, business and traditional authority organisations that are involved in FRM.

4.2 Potential key stakeholders of flood risk management

Analysis of the results from potential key holders of FRM in the city of Accra, Ghana, show that organisations from international, national, regional, district (metropolitan) and sub-metropolitan (similar to zonal, community or unit) levels as well as non-governmental, business and traditional bodies participate in FRM in the city.

4.2.1 Potential key stakeholders on international level

Table 4 shows potential key stakeholders from international organisations that participate in FRM. The organisations are derived from analysis of documents and interviews. The documents include the NADMO Act 517 of 1996, National Disaster Management Plan 2010, the National Operating Standard Procedures for Emergency Response 2010, the National Disaster Management Contingency Plan 2010 and the Metropolitan Disaster Management Plan 2010 for the Accra Metropolitan Assembly. The potential stakeholders are listed against their involvement in task of FRM in the study area.

Findings from review of disaster management documents suggest that international organisations perform tasks in FRM in the city of Accra. Involvement of organisations in FRM can be through research and documentation of flood hazards, evaluation of flood vulnerability and reduction of flood risk. Participation of the organisations appears more obvious in risk reduction task of FRM.

Table 4 Potential key stakeholders of FRM on international level

Potential key stakeholder in FRM	Tasks in FRM		
	Risk analysis	Risk evaluation	Risk reduction
United Nations system:			
United Nations Development Programme (UNDP)	e.g. UNDP; UN-Habitat; OCHA; UNEP: research and documentation and monitoring	e.g. UNDP; OCHA; UNEP: evaluation of flood risk	UNDP: Provides policy and technical support, public education, relief support
United Nations High Commission for Refugees (UNHCR)			UNCHR: relocation; resettlement; emergency shelter
United Nations Habitat for Human Settlements (UN-Habitat)	Research and document of flood-prone areas	Evaluation of flood risk	Emergency shelter and relocation
Coordination for Humanitarian Affairs (OCHA)	Research and document of flood-prone areas	Evaluation of flood risk	OCHA: relief supplies UN-Habitat: helps in relocation of prone communities
United Nations Environmental Programme (UNEP)		Evaluation of flood risk	Provision of portable water
United Nations Children Education Fund (UNCEF)	Research and document of flood-prone areas		
World Health Organisations (WHO)			WHO: provides emergency health supplies, public education on cholera and dysentery
European Union,			Relief supplies e.g. from Disaster Relief Emergency Fund (DREF)
Economic Community of West African States (ECOWAS)			Relief support

Potential key stakeholder in FRM	Tasks in FRM		
	Risk analysis	Risk evaluation	Risk reduction
United States United States Agency for International Development (USAID), Federal Emergency Management Authority (FEMA)	FEMA: research, documentation and monitoring	FEMA: Evaluate risk (Geographic Information System (GIS) laboratory for recording flood risk	USAID: Relief and financial support FEMA: train staff of government organisations; provides logistics
Japan International Cooperation Agency (JICA)	Research, documentation and monitoring	Evaluation of flood risk	Relief, technical and logistics support
The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)	Research, documentation and monitoring	Evaluation of flood risk	Build capacity of national organisations in risk awareness and communication
World Bank	Research and documentation e.g. Flood and Early Warning System FEWS	Evaluation of flood risk	Technical and logistic support (weather forecasting, flood recording

Source: Adapted from NADMO (2010: 18-20).

This point is explained in the National Contingency Plan (NCP) 2010 of Ghana that:

> To ensure a rapid response in the event of an emergency at the time of occurrence, NADMO/NTRR will maintain standing readiness to provide initial relief assistance according to respective core agency commitments. In the event of an emergency, which exceeds the government's capacity, the United Nations System/OCHA will support government (NCP of NADMO 2010: 8).

Again, it is stated in the disaster management plan (NADMO, 2010) for the AMA that international organisations are involved in reconstruction when a disaster occurs:

> Reconstruction will be capital intensive and will also require specialised agencies and equipment. The following actions would be required: The relevant agencies should restore expeditiously the facilities mentioned above. Disaster managers should liaise

> with development planners, NGOs, United Nations agencies and other relevant agencies in assessing the scale, scope, extent and requirements for the rehabilitation, resettlement and reconstruction of affected communities (NADMO, 2010: 28).

Management of disaster is part of FRM. National Disaster Management Plan 2010 of NADMO outlines a national framework for managing disasters in Ghana, and advocates for the maintenance of relations with international organisations in this regard:

> NADMO shall maintain relations with relevant international organisations such as the UN system, NGOs, FEMA, and the International Civil Defence Organisation (ICDO), co-operate and liaise with these organisations on matters of disaster management (National Disaster Management Plan of Ghana, NADMO, 2010: 29).

In the AMA disaster management plan, the need to maintain cooperation with international organisations in risk management is stated clearly that as part of:

> International Level Cooperation, AMA with assistance from NADMO, will maintain relations with relevant international organisations (such as UN Systems, Adventist Development and Relief Agency (ADRA), Federal Emergency Management Agency (FEMA) etc.) and cooperate and liaise with these organisations on matters of disaster management as and when the need arises (NADMO, AMA 2010: 42).

The preceding quotation suggests that there is effort to attract attention of international organisations to the management of disasters in the city of Accra. Disaster management implies response to all disaster risks and FRM is a major component. NADMO (2010) indicates that international organisations are involved in FRM in the study site. UN-Habitat (2009, 2011) conducts studies on urban profile, stakeholders and climate change related risk in Accra, among which flood risk is common. The UNEP/OCHA (2011) also conducted rapid appraisal of 2011 flood disasters in the city. FEMA, in collaboration with NADMO train staff of government organisations for emergency response to disaster risk (NADMO, 2010).

Empirical results from expert interviews also support the evidence of documents analysis that organisations from international level participation in FRM in the city of

Accra. As in the following quotation, international organisations engage with high-level disaster managers through to local communities in response to disaster risk:

> Policies from us are informed by whatever we receive from the grass root. One of our projects that deal with community resilience and early warning system (CREW) is a project based on indigenous knowledge and community based activities. We have contingency plans in the Northern regions and other regions, not only in the Greater Accra. At the national level, we have done a lot through workshops and meetings where we invite ministers, district chief executives (DCEs), parliamentarians and the president. We advocate that government should have these plans implemented and the legislature is supposed to do the work that is given to them (INAS representative August 2013).

Further expert interviews showed that organisations in the UN System are involved in shaping FRM policies in Accra, Ghana:

> United Nations Development Programme (UNDP) mandate is normally to collaborate with governments in their development efforts. We provide policy direction (1) and strategic decision making to support government (2) in addressing flood related issues. The support comes first as a technical support and providing funding to meet government efforts to meet funding gaps in dealing with floods. We frankly do not work directly on the ground. We work in collaboration with so many actors. In terms of coordination we have an inter-agency groups for emergency and this comprise of UN agencies, government agencies; NGO's both local and international. In these NGOs, we also have smaller groups like the faith-based organisations. They are all part of this inter agency and we normally hold coordination meetings with them to know who does what. When we know where your interest lies, then we know where the gaps are and then we see to it that we can work together and address such issues. But for the UN, what we have done is that, like I told you earlier, we also saw this to be a big problem so what we did with the national authorities was to develop a contingency plan which will serve as a guide so that the activities and plans are clearly spelt out to prevent or minimise any occurrences. We know what is stated there and so everybody knows what to do. We also organise simulation exercise on this contingency plan so that these roles are tested by the national stakeholders so that we know what to do if there are any eventualities. If you look carefully we have the collective team and have an inter-agency emergency team that we meet to discuss these issues and also develop basic plans which are our guide. So, like I said, we have tested the contingency plans in our simulation exercise. We do not provide the relief because it is not our mandate; it is the other UN organisations like UNICEF, UNCHR, RED CROSS and others (IDP representative, August 2013).

Other expert interviews indicate that German International Cooperation (GIZ) supports organisational capacity building for risk awareness and risk communication dimensions of FRM:

> The GIZ provides advocacy and capacity building of NADMO, Ghana Health Services and organisations at the national level in FRM on preparedness, pandemics and risk communication. We (GIZ) train staff of NADMO and national organisations in disaster management we developed hotline and upgraded website of NADMO for risk communication. Our focus has been on institutional capacity development (Representative of IIC, July 2013).

Research participants again argue that the World Bank takes part in FRM by supporting national organisations to monitor and forecast flood events. Flood and early warning system (FEWS) program was initiated as indicated in the following quotation:

> The World Bank assisted four institutions; Ghana Meteorological Agency, NADMO, Hydrological Services and Water Resource Commission to install and run flood forecasting model called the FEWS Volta (flood and early warning system Volta). It is at the moment zooming at the White Volta basin. You can run it using flows and meteorological information and see what will happen in a week. Last year, we did it and we were able to predict the flooding that occurred in the northern Ghana. So based on that the World Bank has given these four institutions some amount of money, $800,000 US to fine-tune the model and extend it to cover the Oti and the Black Volta Basins (NGA, August 2013).

The key informant interviews further point to Japan International Cooperation Agency (JICA) as an international partner in FRM in the city, Accra:

> We have a JICA facilitated project involving Ghana Meteorological Agency (GMet), University of Ghana, University for Development Studies, UN University, Tokyo University and Kyoto University. As part of the research programme, we have been able to procure equipment to start running the weather forecasting model at GMet. This is a plus and it will go a long way to give us accurate and good lead-time forecast and warnings for flooding situations. The equipment has been procured; they are test running it in Japan. Two of our meteorologists will be going to Japan this year to train and next year they will be test running here in Ghana. This is a move to address the problems of flooding not only in Accra but also across the country. It is part of the programme to installing radar systems to cover the entire country because

> the radar we have now covers only 250 kilometres concentric Accra (Representative of a HDS July, 2013).
>
> With the little resources that we have, we tried to do that. Fortunately, Japanese people gave us machinery, bulldozers, excavators and other vehicles. With these logistics, we dredged most of the gutters in the city of Accra and this has toned down the flooding (NADMO representative August, 2013).

These empirical findings indicated that international organisations are actively involved FRM of the study site. The findings however, demonstrate that although international organisations participate in FRM in the city of Accra, their contribution is more focused on emergency risk reduction than direct involvement in the Accra Metropolitan Disaster Management Committee, which is the management body responsible for preparing plans for FRM. An exception seemed to be in policy direction, where UNDP supports development of AMA disaster plans through organisations at the national level.

4.2.2 Potential key stakeholders in flood risk management at the national level

Document analysis and expert interviews on potential key stakeholders of FRM in the city of Accra on national level show that FRM is embedded in general disaster management in Ghana, and it is structured to involve organisations from various levels of government. Findings from documents analysis (National Disaster Management Organisation Act 517 of 1996, the National Disaster Management Plan, National Contingency Plan, and the National Standard Operating Procedures for Emergency Response, all of NADMO, 2010) suggest that FRM is a national security issue and involves organisations from national level. The National Contingency Plan of NADMO (2010: 7, 10) further shows involvement of specific stakeholder in FRM in Accra. The smallest unit is the zonal (sub-metro) disaster management office that reports to its district office. The regional coordinator links national and districts disaster management organisations. Regional coordinators further provide warehouses to store stockpiles of emergency relief items (National Disaster Management Plan of NADMO, 2010: 20). On the part of disaster monitoring, the responsibilities of the national and regional levels are defined for the disaster.

Structure of disaster management organisation is shown in Figure 4. As indicated in the Figure 4 (from top-down), instructions and resources for FRM flow from national

level organisations to regional, district and the zonal levels. The reports on FRM, however, flow from zonal, through district to regional and national level organisations. The president appoints NADMO coordinators at the various levels and has powers to declare a state of emergency for a flood disaster in the study site based on advice from the National Security Council. Declaration of state of emergency allows for external support to disaster victims.

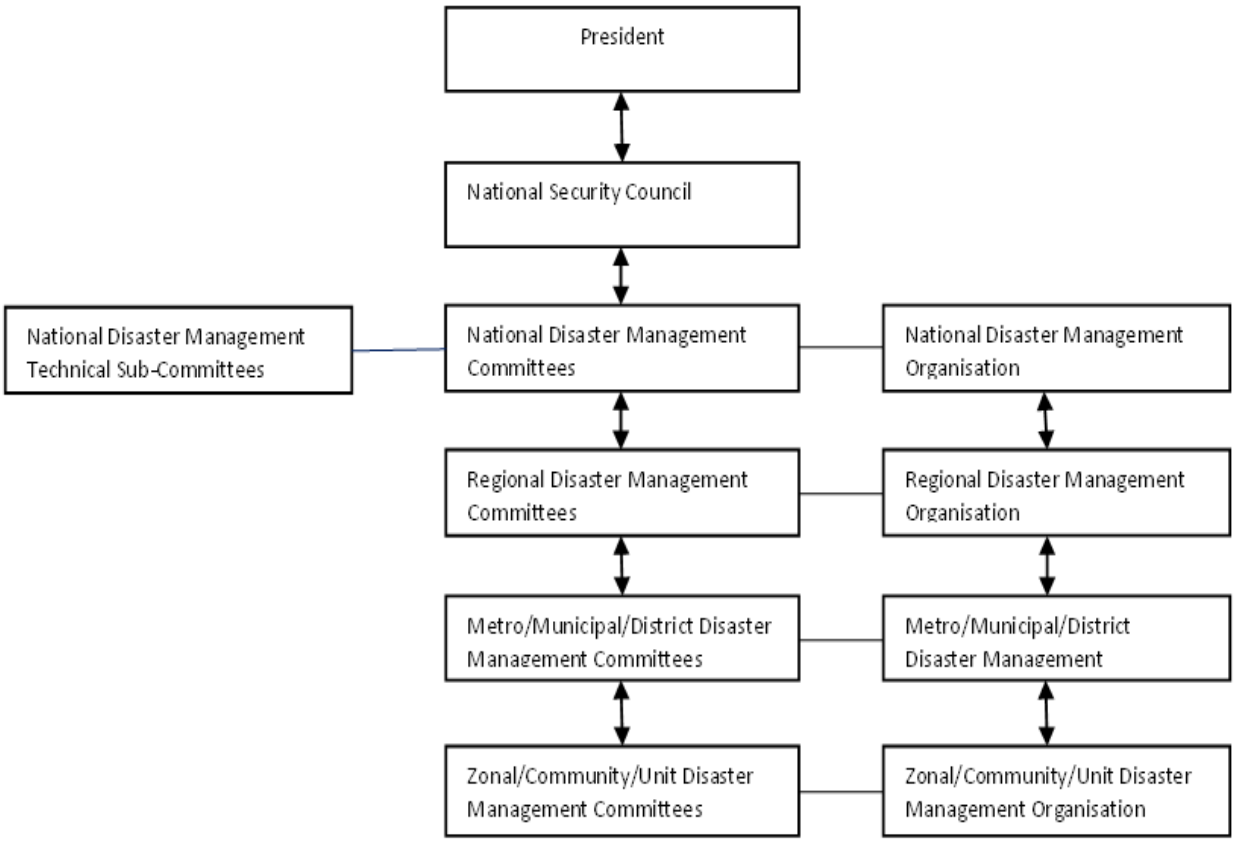

Figure 4: Structure of disaster management in Ghana

Source: Adapted National Disaster Management Plan (NADMO 2010: 26).

National Security Council is informed of flooding and its related activities through reports from the National Disaster Management Committee of NADMO. Regional Disaster Management Committee of the NADMO receives reports from district (metropolitan, municipal) disaster management Committee. District level is further decentralised to zonal/community/unit committee. This top-down to bottom-up connection of the organisations is shown by vertical lines with double-edged arrows in Figure 4. The horizontal lines link the committees of NADMO at each level. Although, it is not visible in Figure 4, parliament and cabinet fall within the loop as enactors and approvers of laws for risk management.

The findings from the documents analysis (National Disaster Management Organisation Act 517 of 1996, the National Disaster Management Plan, National Contingency Plan, and the National Standard Operating Procedures for Emergency Response, all of NADMO, 2010) suggest that, FRM is a national security issue, and involves organisations from national level.

For instance, the National Contingency Plan of NADMO (2010: 7, 10) mandates national organisations to participate in managing disasters in Ghana. In a more specific way, the Accra Metropolitan Disaster Management Plan 2010 suggests that national organisations participate in FRM in the city:

> AMA (Accra Metropolitan Assembly) will cooperate with other response organisations such as Ghana National Fire Service, Ghana Police Service, Ghana Armed Forces, Ghana Health Service, Ministry of Food and Agriculture, Ghana Meteorological Agency, National Ambulance Service, Ghana Atomic Energy Commission, Council for Scientific and Industrial Research, Private Sector etc. through appropriate memorandum of understanding (MOUs) for an effective prevention, mitigation, disaster reduction and emergency response and relief (NADMO, 2010: 42).

The National Disaster Management Committee is tasked with the duty to monitor the implementation of the disaster management plan through regional to the district levels. Part of the National Disaster Management Plan of Ghana states that:

> The National Disaster Management Committee will be responsible for monitoring progress of implementation of this plan at the national level. The regional Disaster Management Committee will be responsible for monitoring at the regional and district levels (National Disaster Management Plan, NADMO 2010: 26).

For instance, in the 2009 and 2011 flood events, the government officials visited the disaster scenes and pledged their support for the flood victims. The President, Greater Accra Regional Minister and the AMA Chief Executive visited the hardest hit flood prone areas to express their concern and offer material support for the victims.

> So most often, when there is a disaster, the government is seriously involved in this because the President at times moves down to see the problem and he releases funds for taking care of the place and giving compensation to people who have been flooded, and their properties have been carried away and all that. So these are some of the strengths you know. … Meetings with the Minister, we organise monthly meetings and then we discuss how to check floods; then we have Committee on Environment. …in the other words, they are politicians and form committees and the

> technical people are invited by them and then we discuss these problems when they occur especially we visit the flood prone areas and see whether a new drain is supposed to be constructed or that kind of thing. It is the assembly under the AMA that is initiates and it is able to invite stakeholders from outside, Member of Parliament and other stakeholders to also attend for a decision to be taken. And then when it is approved by the assembly then action is taken (LWD representative, August 2013).

Based on the above quotation, it is obvious that politicians from the central, through to the local governments affect FRM in Accra, particularly after a flood disaster. Politicians make promises to deal with flood risk and offer relief to victims of flood disasters.

This shows that national and regional level organisations of FRM in Ghana include disaster management committees, consisting of representatives from government and Non-Governmental Organisations (NGOs). The Regional Minister (RM) is a government figure who spearheads protocol visits to flood-hit communities to assess impacts of the flood disasters. The RM is responsible for the region in which a disaster occurs and also a member of Regional Disaster Management Committee. Instructions of a Greater Accra Regional Minister in FRM were expressed in the expert interviews:

> When Regional Minister came to our first meeting, he said he did not want to see any deaths during floods this year. FRM is a top priority (LND representative, August 2013).

Expert interviews also show that NADMO national headquarters and Ghana Hydrological Services Department are involved in FRM at all areas in Ghana:

> What happens is that even though hydrological services department has offices in all regions we do continuous monitoring of the rivers and so on. With regards to flooding NADMO has people in the various districts and so they monitor and then they predict that there will be disasters then they relay the information to district offices and then to regional and national offices (SHS representative, August 2013).

Organisations at the national level also affect FRM through information and public education floods.

> Public get FRM information from the print press, electronic media (radio, website, television), brochure, flyers, music, information van with public address system,

> clean-up exercise and, durbars, at the National and Regional Platforms for disasters risk reduction, (no information district platforms) (LND representative, August 2013).

Based on this study, the Table 5 shows the potential stakeholders at the national level in Ghana.

Table 5 shows a list of organisations of FRM in the study site on national level drawn from document analysis and interviews with reference to the conceptualisation of FRM tasks in Section 2.1.3. National Disaster Management Plans point out that there is cooperation between NADMO and national organisations for managing disasters:

> NADMO shall co-operate with other response organizations such as Ghana National Fire Service, Ghana Police Service, Ghana Armed Force, Ghana Health Service, Ministry of Food and Agriculture (MOFA), Ghana Meteorological Agency (GMet), National Ambulance Service(NAS), Ghana Atomic Energy Commission, (GAEC), Council for Scientific and Industrial Research (CSIR), through networking for effective disaster reduction and emergency response programmes (National Disaster Management Plan NADMO 2010: 28).

The expert interviews also confirm this collaboration as the follow quote reveals:

> Our collaborating agencies are the security agencies (military, police, fire service, ambulance service), the local government institutions (the metropolitan, municipal and district assemblies (MMDAs), private sector, and NGOs. At the moment, the MMDAs have the power to enforce land-use regulation and to breakdown structures on waterways in Ghana. So we, NADMO have to collaborate with them. The NADMO officers go round to identify such structures and they inform the MMDAs to demolish such structures. If you go round in Accra, you will see such structures being written on - *stop work* but the developers don't stop work (SRR representative August 2013).

National Disaster Management Organisation (NADMO) of the Ministry of the Interior coordinates with agencies at all levels of disaster management through its specialised units and committees. NADMO has various departments focusing on different components of disaster risk management. For the focus of this research, Urban Search and Rescue Team of the Emergency Operations, Relief and Reconstruction and Hydro-meteorological Disaster Units (committees) of the organisation are of interest. These units are considered since they are specially created to perform specific tasks, including nationwide FRM.

Table 5 Potential key stakeholders in FRM on national level

Potential key stakeholder in FRM	Tasks of FRM		
	Risk analysis	Risk evaluation	Risk reduction
Presidency		Evaluation of flood risk	Declare disaster zone
Parliament	Research, documentation and monitoring	Evaluation of flood risk	Makes laws for risk management
National Security	Research, documentation and monitoring	Evaluation of flood risk	Removal of hazard
Ministry of the interior	Research, documentation and monitoring	Evaluation of flood risk	Evacuation plans and identification of safer places
Ministry of Information	Research, documentation and monitoring	Evaluation of public awareness and information on flood risk	Public information and education
National Development Planning Commission	Research, documentation and monitoring of flood risk	Evaluation of disaster management policies	FRM policies
Security Agencies (Military, Police and Fire service)	Research, documentation and monitoring of flood risk	Evaluation of flood risk and management measures	Provides security; relocation and eviction; search and rescue; Pumps water and post flood clean-up and decontamination
Ghana National Ambulance Service; St. Johns Ambulance Services	Research, documentation and monitoring of flood risk	Evaluation of emergency response to flood risk	Emergency medication, resuscitation and relocation to health facility
Ghana Meteorological Agency,	Research, documentation and monitoring on flood risk	Evaluation of weather forecasting and early warning on flood risk	Forecast rainstorm and floods
Universities and research institutions (e.g. Water Resource Commission - Centre for Scientific and Industrial Research (CIRS)	Research, documentation and monitoring on flood risk	Evaluation of flood risk	Research on FRM and educate public on flood risk
Hydrological Services Department;	Research, monitoring and documentation on	recording floodwater levels, flood recorder	Provides advice on Improve drainage, engineered structures,

Potential key stakeholder in FRM	Tasks of FRM		
	Risk analysis	Risk evaluation	Risk reduction
	flood risk		flood risk mapping
Architectural and Engineers Services Limited,	Hydro engineering services	Evaluation of buildings on water ways	Provide advice on flood risk reduction option
National Disaster Management Organisation - Urban Search and rescue; Relief and Reconstruction, and Hydro Meteorological Disaster Unit.	Identify and document of flood risk	Evaluation of flood risk and maintenance of management measures	Coordinate FRM organisations, flood , public education, relocation and eviction of flood prone communities, provides relief, search and rescue of flood victims,
Volta River Authority	Research, documentation and monitoring on flood risk	Evaluation of early warning and response	Timely flow of information on the opening of dams
Environmental Protection Agency	Research, documentation and monitoring on flood risk	Evaluation of environmental risk and waste management policies	Environmental and waste management for flood risk reduction
National Insurance Commission	Research, documentation and monitoring on flood risk	Evaluation FRM	Flood insurance
Ghana Education Service; National Commission for Civic Education	Research, documentation and monitoring on flood risk	Evaluation of public awareness and information on flood risk	Public education and awareness on FRM
National Media Commission	Research, documentation and monitoring	Evaluation of information and public awareness on flood risk	Awareness and risk communication
Regional Security Council	Research, documentation and monitoring on flood risk	Evaluation of FRM	Policies on FRM
Regional disaster management Committee	Research, documentation and monitoring on flood risk	Evaluation of FRM	Prepare and implement FRM plans

Source: Modified from National Contingency Plan of NADMO (2010: 10).

The Urban Search and Rescue Team is a 24-hour standby operations unit for rapid response to emergency floods. The operations unit monitors development of flood hazards and performs search and rescue duties during flood disasters. Relief and reconstruction unit is charged to manage issues related to the impacts of flood disasters. For instance, as explained in the ensuing feedback from interviews that:

> NADMO has so many departments that work together as whole. Relief and Reconstruction Department is the last resort department when disaster risk could not be managed and triggers off and people have to be moved from search and rescue up to resettlement of flood victims. All the relief that we have to give to flood victims, including psychosocial relief which means counselling and items we need to give the affected victims. So it is not anything different, it is part and parcel of disaster management (Representative of SRD, August 2013).

The hydro-meteorological committee is in charge of water and weather related risk management. FRM is the focus of this committee. The committee is a platform where various partner organisations responsible for hydro-meteorological disasters come together to share expertise in FRM. The role of the hydro-meteorological (Hydro-Met) committee is explicit in the quote below:

> Hydro-Meteorological Committee is a technical committee, which brings expertise from different stakeholders or sectors that provide advice to NADMO on impending floods. Before the onset of rains we have to meet to plan. What do we do? We have to visit these places, what interventions before the flooding and also visit there after the flooding to see what can be done.…the Hydro Meteorological Committee of NADMO carries out a survey of the flood prone areas in the suburbs of Accra and other areas in Ghana. We look at the gutters to see whether they are silted or not. And if silted, what do we need to do before the rains come? We go to low-lying areas to see which buildings are located and if we find buildings, we have to tell the assemblies to get the buildings out (GMA representative, August 2013).

Results of the expert interviews also indicate that security organisations participate in FRM:

> We have no specific area of disaster risk management. We go into managing all disasters. We search and rescue live and property of the public and also sensitise people on behavioural changes to reduce flood risk disasters. However, NADMO is the mandated institution but does not have the various institutional settings to reduce risks. Hence, NADMO identifies the needed institutions to deal with occurrence of a disaster. We do train alongside with NADMO allied institutions to be battle-ready. Hence our focus is not only into rescuing people but also property. In a nutshell, we are part of the actors involved in in disaster management. We support NADMO to

> undertake the rudiments of flood risk prevention and management. We make our experiences available to NADMO, the mother of disaster management in Ghana. We usually reactivate our standby infrastructural unit to be as prepared as possible for any flood occurrence. During rehabilitation, we do not get ourselves involved as NADMO has the mandate to do that (SAF representative, August 2013).

Research participants explained that security services are indeed needed throughout FRM. The security organisations help to protect life and property during eviction or relocation of developments in flood-prone areas. This role is necessary to ensure smooth operation, void of clashes between the city authorities and property owners. The security organisations are mandated to control such activities. These organisations engage in search and rescue of life and property during flood disasters.

Hydrological Services Department of the Ministry of Water Resources, Works and Housing coordinates with the Drains Maintenance Unit desilt and maintain drains (channels) in preparation for floods. The Ghana Meteorological Services Agency of the Communication Ministry provides early warning and forecast of floods. However, it is argued that information on early warning forecasts of floods is hardly accurate or reliable. The agency is claimed to be under-resourced and lack modern logistics to offer advanced weather forecast and early warning.

The National Disaster Management Organisation (NADMO) of the Ministry of the Interior coordinates with agencies at all levels of disaster management through its special units and committees. NADMO has various administrative units of importance in disaster management. For the purpose of this research, however, the Urban Search and Rescue Team of the Emergency Operations Unit, the Relief and Reconstruction Unit and the Hydro Meteorological Disaster Unit (Committee) of the organisation are of interest. These units are considered since they are specially created to perform specific tasks that include FRM nationwide.

National organisations are disparate from district organisations in the sense that the former have a nationwide responsibility, whilst the latter is limited to the administrative boundary of the AMA. Table 5 outlines the organisations and their involvement in FRM.

4.2.3 Potential key stakeholders of flood risk management from Accra Metropolitan Assembly

This section expounds on potential key stakeholders of FRM in the city of Accra. It must be noted that some of the national stakeholders will also be part of the Accra FRM team. The city of Accra is the administrative capital of Accra Metropolitan Assembly (AMA). AMA functions as a local government that is directly involved in FRM. AMA is decentralised into sub-metros, and not all the sub-metros face flood problems, as noted below:

> It is not all of the sub-metros that are flood-prone but we have spots in the sub-metros which are flood prone. The major areas are the Okai Koi South, which is around the Darkuman area, Ablekuman North around Sakama area, Odawna, Adabraka official town within the Osu Klortey Sub-metro. These are areas prone to floods. This is part of the decentralisation governance structure. The decentralisation process is such that Assembly Metropolitan Accra (AMA) is the overall body and then the various sub-metros have to work within so they can reach out to the people because the AMA alone cannot reach out to all the people. So this structure is part of the decentralisation process (Representative NADMO, August 2013).

AMA has administrative (executive) powers to prepare and implement FRM plans. Sub-metros have no executive power, but have a responsibility to implement them. Thus, sub-metro directors serve under the Mayor (The Chief Executive Officer) of the AMA. In the metropolitan disaster management plan 2010, involvement of the Major is clear:

> The Chief Executive of AMA will be responsible for monitoring progress of implementation of the MDMP. AMA shall ensure that all identified hazards are mapped (MDMP AMA 2010, pp.29-30).

The above quote shows that, the AMA, as a local government administrative body has the mandate to formulate and implement a Disaster Management Plan. This mandate includes, among other activities, hazard mapping, monitoring and the implementation of the Disaster Management Plan.

The Chief Executive Officer chairs the Metropolitan Disaster Management Committee. The committee performs crucial functions in the management of disasters, and it is an important decision-making body in FRM. It is responsible for preparing district disaster management plans, maintaining a close liaison with its

regional disaster management committee and performing functions that the regional (national) disaster management committee or coordinator may direct (Section 16, NADMO Act 517, 1996). Table 6 shows potential key stakeholders of FRM in the city of Accra in reference to the conceptualisation of FRM task in Section 2.1.3.

Table 6 Potential key stakeholders of FRM in the city of Accra

Potential key stakeholder in FRM	**Tasks of FRM**		
	Risk analysis	Risk evaluation	Risk reduction
Accra Metropolitan Assembly Coordinating Unit:	research, documentation and monitoring of flood risk	Evaluation of flood risk and FRM	CEO chairs the disaster management committee; draws and implement FRM plans, responsible for FRM
Town and Country Planning Department	Research, documentation and monitoring of flood risk zones	Evaluation flood risk and land-use regulations and building codes	Prevention of developments on flood-prone areas.
Urban Works Department	research, documentation and monitoring of flood risk zones	Evaluation land-use plans	Relocation, eviction of developments on flood prone areas
Urban Roads Department	Participate in research, documentation and monitoring	Evaluation of flood risk and drainage along roads	Construction and desilting of drains
Drains Maintenance Unit,	Research, documentation and monitoring of flood risk	Evaluation of drainage	Prepares drainage systems for free of flood water
Waste Management Department	research, documentation and monitoring of silted drains and garbage in the city	Evaluate development of silt/waste and evaluation of management of silted drains and waste	Desilting of drains, clearing of waste, and after-flood clean-up
Waste management companies; e.g.	research, documentation and	Evaluate management of waste and silted	Desilting of drains, clearing of waste, and

Zoomlion Ghana Ltd.,	monitoring of silted drains and garbage in the city	drains	after-flood clean-up
Ghana Health Service, Public Health Directorate	Research, documentation and monitoring on environmental health issues	Evaluation of environmental health and hygiene	First aid to flood victims; education on environmental health issues to floods (e.g. cholera, dysentery)
Metropolitan Disaster Management Committee,	Research, documentation and monitoring of flood risk	Evaluation of flood risk and management	Preparing and implementing FRM plans
Information Service Department,	Research, documentation and monitoring of flood risk	Evaluation of public awareness and information flood risk	Public education and awareness on flood risk reduction
Community Development & Social Welfare Department	Research, documentation and monitoring of flood risk	Evaluate flood risk development	Education and awareness on flood risk reduction
Metropolitan Security Council	Identify flood hazards	Evaluate development of flood hazards	Removal of flood hazards

Source: Fieldwork, 2013

The National Operating Standard Procedures for Emergency Response (NSOP) of NADMO in Ghana further outlines the various responsibilities of the district, municipal and metropolitan assemblies in emergency management of disasters. It is noted that:

> Metropolitan/Municipal/District Assemblies: Activate the Assembly's Disaster Response Plans. Assist in clearing the emergency site. Provide equipment to support the operations. Create access routes into in accessible areas. Select and prepare safe havens for evacuated victims. Engage volunteers to assist in response activities e.g. search, rescue, evacuation and registration of victims. Initiate provision of relief to victims. Provide warehousing facilities. Manage waste and ensure sanitation. Control rodents, pests and insects. Assist in the disposal of the dead (NSOP 2010: 11, 16).

The quote indicates that some organisations at local government level are involved in pre-flood, flood-event and post-disaster management. Expert interviews show that sub-metros are implementers of disaster management plans of the AMA:

> Yes, we have a disaster management plan for the AMA. This is a copy of the plan we have. The plan was prepared in the year 2010 but we have not been able to review it. We are trying to put together stakeholders so we can see how to review the management plan. The plan is such that every sub-metro needs to identify disaster risks within its boundary areas. We called it hazard mapping in these our sub-metros (LND representative August 2013).

Organisations of the AMA have responsibility to deal with disaster risks of all forms. FRM falls within this responsibility.

National Disaster Management Organisation Act 517 of 1996 indicated the participation of various groups in FRM. The influence of AMA in FRM ranges from preparedness phase, emergency phase, and post-disaster management phase as summarised in the Table 6.

This mandate of the Accra Metropolitan Assembly is further acknowledged in relation to NADMO as manager of floods in the city of Accra. It is noted that:

> NADMO really is the institution mandated by the law to coordinate disaster management in Ghana. So of course they have the highest mandate, what we go there to do is suggestions and which they can refuse or accept that so in terms of that NADMO really is the key player in terms of managing flood risk in Accra and the AMA itself is also a major player (WVI representative, August 2013).

The quote showed that NADMO has the highest authority to coordinate disaster risk management. What this means is that, the AMA as a district authority is responsible for FRM. The sub-metros share this responsibility.

AMA affects FRM through its responsibility as it was noted in an interview that:

> There have been the two issues causing the flooding the city of Accra. Urbanisation is faster than the pace of spatial planning for urban land-use and development. The district assemblies, the AMA, is supposed to monitor these developments but unfortunately the assembly is face with avalanche of requests for building permits and other issues related to planning and physical developments on land and they are not able to match with the request. So you find people putting up structures in waterways

> but district assembly does not have the muscle to destroy these buildings (GMA representative August 2013).

Follow up arguments contend that the District Assemblies have responsibility to implement and monitor by-laws on land-use and risk management including FRM plans:

> It is the district assemblies; I have been talking about the assemblies because they have the power to do so many things. The assembly has the power to control the city so the authorities have to see to it that their byelaws work. If they implement their bye-laws, they monitor these laws, and the people do not build on wrong places and wrong thing is not done, gutters available are covered, some of these problems with flooding will be gone (SRR representative, August 2013).

This quotation suggests that organisations of AMA have statutory responsibility to be involved in FRM. The AMA has powers to prepare and implement FRM. However, one of the major problems causing poor implementation of FRM is the lack of adequate funds from the central government:

> … Financial challenges are the main ones apart from the human activities, which turn to negate our effort. … People still build within the flood-prone areas and dumping refuse into drains. What affects our projects is funding. We don't get the full complement of what we need to be able to take the activities of each year. The resources given us are not enough (SHS representative, August 2013).

Consequently, organisations are unable to implement FRM plans. The organisations have responsibilities to manage flood risk but have no adequate resources to implement FRM. This challenge explains why organisations responsible for waste management, early warning of floods and enforcement of land-use regulations and buildings codes failed to perform such functions adequately. Engineering projects, particularly construction of channels end up being undertaken in a piecemeal manner. This situation makes some stakeholders unable to perform their roles in implementing FRM plans for the city, Accra.

4.2.4 Potential key stakeholders from non-governmental organisations

Results of document analysis demonstrate that non-governmental organisations (NGOs) are involved in FRM in the city of Accra. Section 3 of NADMO Act 517, 1996 confirms membership of NGOs and religious groups in disaster management. The

document analysis indicated participation of NGOs in tasks of FRM in the city (NADMO, 2010: 6). In addition to participating in analysis and evaluation of risk, findings from the document analysis suggest NGOs are actively involved in FRM, especially in response to flood disasters. Section 9.3.4 of the Metropolitan Management Plan 2010 of Accra Metropolitan Assembly (NADMO, 2010: 28) focuses on hydro-meteorological disasters, and it states that:

> Disaster managers should liaise with development planners, NGOs, UN agencies and other relevant agencies in assessing the scale, scope, extent and requirements for the rehabilitation, resettlement and reconstruction of affected communities.

The above quote showed that NGOs are involved on the tasks of FRM since floods are also common hydro-meteorological disaster in the study site. The NGOs however, mainly offer humanitarian support during flood disasters. In fact, the National Standard Operating Procedures for Emergency Response 2010 of NADMO has an NGO Consortium's Disaster Response Plan to:

> Assist in damage and needs assessments. Assist in registration of victims. Support in the provision of relief to the affected persons. Assist in the triage of casualties as required. Assist in the provision of First Aid services as required. Provide psycho-social support. Maintain complete records of all actions, activities and costs. Provide water purifiers (NADMO, 2010: 17).

Expert interviews also confirm participation of NGOs in FRM, especially in emergency relief and first aid to flood victims:

> In fact, we have a mandate in response to flood disasters. This organisation is established by law in Ghana and our mandate to prevent loss of lives by providing first aid to disaster victims. It is this mandate that makes us aware of roles (IGO representative, August 2013).

Table 7 Potential key stakeholders of FRM from NGOs

	Task of FRM		
Stakeholder of FRM	Risk analysis	Risk evaluation	Risk reduction
Disaster Volunteer Groups (DVGs)	Identify, document and report flood risk	Evaluation of flood risk	Report flood risk to NADMO office, Search, rescue and evacuate,

World Vision International, Ghana	Participates in documentation of risk	Evaluation flood risk	Provide , funds for FRM, humanitarian relief
St. John's Ambulance Services,	participate in flood risk analysis	Evaluation of flood risk	First aid medication and relocation health emergency evacuation
Ghana Red Cross Society (GRCS),	Participates in research, documentation and monitoring of flood risk	Evaluation of flood risk	relief, counselling services for flood
Religious: Catholic Relief Service; Adventist Development and Relief Agency;	Participates in research, documentation and monitoring	Evaluation of flood risk	relief; counselling services
Human Rights Activists (e.g.Amnesty International, Ghana)	Participate in research and documents of flood risk	Evaluation of risk	Support action against eviction of flood-prone communities
Slum Union of Ghana; Old Fadama Association	Participates in research and document	Evaluation	Supports relocation but resist eviction of settlement in flood-prone communities

Source: Adapted from MADMO (2010: 24-25)

The Table 7 shows resulst of the potential stakeholders based upon the conceptualisation of FRM task in Section 2.1.3. Empirical findings from the expert interviews further support results of the document analysis:

> When flooding causes destruction of property and displacement of people, organisations contacted to mobilise relief. Ghana Red Cross appeals to the external disaster counterpart to support. We have our volunteers and we are also representative of the Ghana Red Crescent Society at the Relief and Reconstruction Committee of NADMO (NRS representative, August 2013).

This study further showed that, NGOs support NADMO and local communities in public sensitisation, clean up and de-silting of drains in preparations for floods in rainy season. For instance, research participants argue that:

> FRM starts from education. It starts with management to prevent it, the preventive aspect of it is very key. And to prevent it you need to educate the people in the first place and going to prevention means that ensuring that the gutters are not choked. Recently, about a month ago, the World Vision International sponsored one sub-metro office of National Disaster Management Organization in Accra, to undertake some clean-up exercise in areas they identified that are possible to cause flooding during the rainy season. The World Vision also gives sub-metros some money, the tools to go and organize clean-up exercises. That is what we see; it is the preventive aspect that we believe in (GVI representative, August 2013).

Similarly, religious organisations also offer humanitarian support for victims of flood disasters. They respond to immediate emergency first aid supports in the form of food, clothing, and shelter provision (NADMO, 2010). NADMO coordinates relationship with major religious donors in planning for disaster risk management.
Expert interviews indicate that Slum Union of Ghana is a local NGO in Accra involved in FRM:

> Slum Union of Ghana as the name goes is the union of slum dwellers and because we have a lot of slums in Accra, our activities covers most areas in Accra and what we are doing currently is trying to map the cities where we have slums so that these areas can be used to construct roads, gutters and other drainage systems so that water can flow easily whenever there is a downpour so that we can avoid flooding here and we want to do this in collaboration with the city authorities. …as the largest slum area in Accra and Ghana, whenever there is any problem, the first point of call by the media is me. The city authorities and I meet from time to time to discuss issues concerning the community. If they want to take any decision for the community we need to be consulted first by the authority and find out if we are in agreement with the decisions before they are implemented. To some extent we are involved in decision making process (LSG representative, August 2014).

Disaster volunteer groups (DVGs) are a grass-root organisation that also participates in FRM. DVGs involve in FRM with the task to identify and document flood hazards and flood vulnerabilities for further action. DVGs are a voluntary organisation. DVGs are frontline responders to flood disasters in communities since its members live in local communities. They also have the mandate to create awareness of flood risk. Its

members are not paid for their services so they leave in search for job opportunities. Sustaining DVGs is therefore, a major problem, as indicated in an expert interview:

> We are also trying to empower the communities by forming disaster volunteer groups (DVGs) in the various communities. We have played our part by trying to put the groups together but we have not been able to sustain them financially. We need to pay them but finances are unavailable. We empower the DVGs through training programmes. We train and teach them what to do when there is flood, after flood and before flood. These also include to identifying flood flashpoints and waste management strategies (LND representative, August 2013).

Expert interviews further show that community development organisations participate in FRM in the city of Accra.

> Due to floods, several eviction attempts have been made since 2003 and the worst of it all was in 2009 and because of this, individuals in the community came together to form the Old Fadama Development Association to serve as the mouth piece for the people and that is why I am the spokesperson here. My involvements have been to hold press conferences to tell the media and Ghanaians that the community is not the home for criminals and other deviant**s**. Also because of the activities Amnesty International and Slum Union International I have the opportunity to travel and present our case. …The success we have chalked is that we have not been evicted and because they were really serious in doing it. We have public sympathy and institutions like Commission for Human Rights and Administrative Justice and other international organizations who speak for us and also put fear in the city authority. Also because Ghana also depends on these international organisations, they are very careful whenever they are dealing with us. We are also quick in getting their supports (SUG representative, August 2014).

The quote above demonstrates that Old Fadama Development Association with support of human rights organisations involved in FRM by resisting eviction of communities considered flood-prone. Old Fadama is a slum community in the city that is noted to be flood-prone. Eviction is a human right issue. Human right activist-related organisations seem to also support the association against eviction.

The results presented can be interpreted that, non-governmental organisations have involved in FRM mainly at flood risk reduction phase. Whereas some support flood victims with relief, others fight against eviction of settlers from flood-prone areas as a human right issue.

4.2.5 Potential key stakeholders from business organisations

Business organisations participate in FRM in the city of Accra. Documents analysis and expert interviews showed that waste management companies, estate developers, engineering consultants, utility services, transportation businesses and media organisations are potential key stakeholders in FRM. Disaster Management Plan 2010, (NADMO 2010: 15-16) noted the support of businesses and companies in disaster management in Accra. This support extends to FRM in the city of Accra. Accra Metropolitan Disaster Management Plan (2010: 19 - 25) points to business organisations as partners in FRM. The media for instance, contributes to public education and information on FRM. Utility services and other forms of business support FRM materially and financially.

National Standard Operating Procedures for Emergency Response (NADMO, 2010) shows that business organisations participate in FRM. Participation of the media is captured in this document:

> Media set-up and support information post, provide timely and accurate information and update the public on the operations and ensure that all information is confirmed with the emergency Operations Centre before dissemination to the public (NSOP NADMO 2010: 15-16).

The media (print and electronic) are a stakeholder in public education and information disaster risk in general (The Accra Metropolitan Disaster Management Plan 2010: 19, 25).

Although the media participation cannot be underestimated in FRM, findings from expert interviews suggest that relationship between the media and Ghana Meteorological Agency is not cordial.

> Anytime there is a warning, the first flood warning goes to NADMO because there is realisation that NADMO has capacity in the district, it also has a very good relationship with some of the press houses. Unfortunately, the GMA has not so good relationship with the press/media per se. The communication link is not good at all so the best communication link is always through NADMO. NADMO has a good relationship with press as well as having a network on the ground at the district level so they can easily disseminate such information (GMA representative, August 2013).

The interviews further indicate that in most cases, the media do verified information before publishing it:

> Disaster risk information is not well crosschecked before dissemination to the public by the newspapers (Representative of AMD, 11th September 2014).

All these issues seem to cause confusion and conflict in FRM.

The waste management department therefore, besides public education on waste management, makes contractual arrangements with waste management companies to support in managing solid wastes in the city Accra:

> Accra currently is generating 2500 tons (of waste) per day. 2500 tons of solid waste is generated per day and we have managed to collect averagely 2200 tons a day. So the difference is that we have some amount of uncollected waste remaining in the system every day. You see it, and that is the insanitation. So what we are trying to do is to encourage our private companies to bring new trucks because their trucks are old. You see and so they're not able to make the number of trips that they are supposed to make. Secondly, public negative attitude; some people even refuse to declare the waste you know they want to litter it throw it into drains and places, that is attitude. And they do this at the blind side of the AMA. So you wake up even in the morning and you find waste along the streets, and the drains whatever. They do it at the blind side so what we're doing is to enforce our bye-laws, continue to strengthen our public education system and then effective waste collection. Nine private companies and Zoomlion is one. Nine private companies have been contracted to clean up Accra (LWD representative, August 2013).

Table 8 shows results of the potential stakeholders from business organisations with reference to the conceptualisation of FRM task in Section 2.1.3.

However, solid waste is still a problem because private companies seem to be overwhelmed by its enormity. This is exemplified by the apparent choked drains and roadside gutters in most parts of Accra. It was confirmed that nine waste management companies have contracts with the AMA to manage waste in the city.

Interviews suggest that real estate developers' association are not members of the AMA disaster management committee and may seem not to be directly involvement in FRM.

Table 8 Potential key stakeholders of FRM of business organisations

Potential key stakeholder in FRM	Tasks of FRM		
	Risk analysis	Risk evaluation	Risk reduction
Utility services	Research, documentation and	Evaluation of FRM	Pre-flood clearing of drains of cables and
Waste management companies	Participates in flood risk research, documentation and monitoring	Evaluate waste in drains and flood prone communities	Pre-flood clean-up and desilting of gutters waste
Businesses	Participate research, documentation and monitoring of flood risk	Participate research and documentation of flood risk	Donations for flood risk reduction
Media (print, electronic, radio and television)	Participates in flood risk research, documentation and monitoring	Evaluation of education and public awareness of flood risk	Reports and create public awareness on flood risk
Ghana Real Estate Developers Association	Participates in research, documentation and monitoring on flood risk		land-use regulations and building codes in development of estates
Private Health Facilities	Participate in research, documentation and monitoring of flood risk		Volunteer to provide medical support to flood victims
Private transport organisations	Participate in research, documentation and monitoring		Volunteer to evacuate victims of flood risk

Source: Modified from NADMO, 2010

> Our organisation, the Ghana Real Estate Developers Association (GREDA) is not on the committee, but it is on other committees I think so. It is not on our committee (PSO representative August 2013).

This means some of these organisations are not directly involved in FRM although their activities in the study site may intensify or reduce flood risk. For instance, activities of utility services may criss-cross drains. Urban waste from private companies and individuals may also block drains. Similarly, construction of physical structures on waterways by individuals and mortgage companies can impede flow of

water in their defined courses. Contrarily, private organisations may also engage in FRM to reduce flood risk. For example, Zoomlion Ghana Ltd. is a waste management organisation in Ghana that partners with AMA to clear waste and desilt drains in Accra. Similarly, the renovation of existing drains and construction of new ones also involve private organisations in AMA. **Figure 5** shows activities of utilities companies that interfere with FRM measures in the city of Accra.

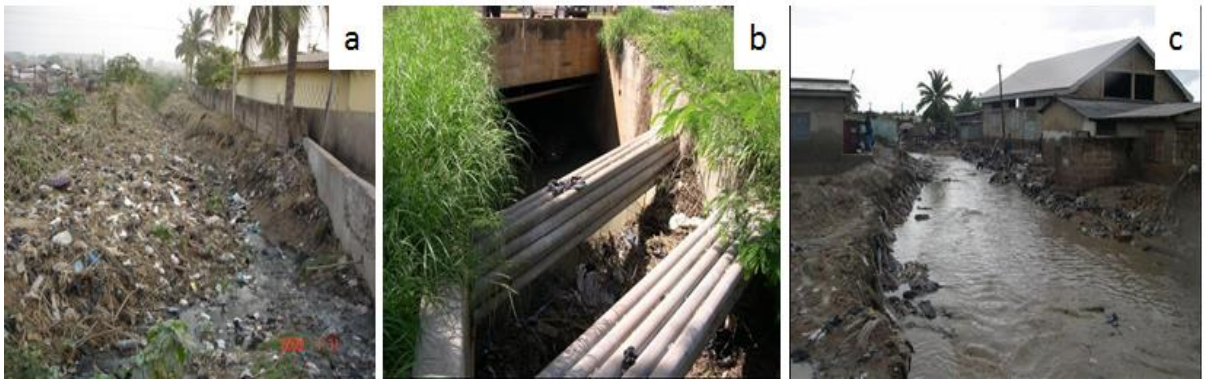

Figure 5: Illustrates (a) dumping of refuse in drains, (b) utility lines crossing drains and water channels and (c) buildings in waterways in flood-prone in areas in the city of Accra

Source: Field work 2014 Pictured by Ghana Hydrological Service Department

Based on the interviews of this study, a typical quotation that supports the illicit behaviour of individuals contributing flood risk in the city of Accra is that, whereas:

> The city is well planned on paper; the plans are not well followed to the latter. E.g. high flood risk areas are occupied with infrastructural developments. High and low flood risk areas are mapped but in practice, not. The interchange around Malam in Accra is a typical example of a high risk area because it serves as a water collection point. There used not to be flooding in Accra for a long time. Modernisation and disregard for orderly behaviour have contributed to impeding the natural waterways. Runoffs are diverted by the illegal structures and dumping of refuse into drains. Aesthetic beauty of infrastructure is leading to the reduction of natural infiltration e.g. concrete pavements (SAF representative, August 2013).

The research participants expressed in the interviews that infrastructure network of utility services providers such electricity wires, pipeline, telephone cable may cross drains to block flow and divert water from rainstorm to cause or intensify flood risk: Utility services seem to affect FRM in the city of Accra. This is expressed in the

expert interviews that electrocution is one of the causes of deaths during flood in Accra:

> The major flooding we experienced is the 26th October 2011, which actually affected almost all 11 sub-metros of the Accra metropolis. The flood affected properties as well as human life. We had nine of our people dead through electrocution as well as being washed by the floodwaters (HMC representative, August 2013)

> There may be some conflicts in the way we do some things in Accra. Like when Electricity Company wants to undertake a project where they need to lay cables and so on, they should involve other agencies so that we can all sit down and plan. So that when electricity cable is passing through a drain, I would be aware and I would advise how it could have been done. Other departments too, the way road construction and so on are done. Constructing the drains instead of getting the drains de-silted before putting culverts on them because that is not their job, they can't wait till the city authorities do the de-silting before they are done. These utility services; telecommunication line, water and sewage, electricity have been creating problems for us (LND representative, August 2013).

It is explicit in the quote that activities of utility companies impede designed functions of FRM strategies. It further shows that utilities services do not coordinate with FRM plans of the AMA. The engineering companies offer technical advice to government organisations responsible for FRM.

4.2.6 Potential key stakeholders from traditional authorities and opinion leaders

Traditional authorities and opinion leaders participate in FRM in the city. Document analysis and interviews support this revelation. The Accra Metropolitan Disaster Management Plan (NADMO 2010: 18, 25) indicates that traditional authorities, such as chief and land owners are involved in FRM through public education, provision of emergency shelter and the provision of land for resettlement of flood victims. Table 9 Traditional authorities, parliamentarians and assembly members of local communities.

The plan also sees opinion leaders and traditional authorities as being part of FRM in the areas of public education and awareness. These stakeholders however, have specific membership in the disaster management committee of the metropolis. Research participants in the interviews argue that the traditional authorities seem to have power in local areas to affect FRM:

> …the chiefs have power to control illegal encroachment of water ways. When you study Accra, after buying the land from the chiefs you still have to pay the local police force which is the "Asafo Group" before you can start building. The Asafo Group normally monitors the activities on the land as the land belongs to the traditional authorities. When the city authorities make decision without the traditional council getting involved, they would encounter some challenges when they get to the implementation stage because they will not be having the support of the chiefs and their people. They would show some resistance. I think chiefs should be involved right from the onset (LTA representative, August 2014).

Some of the research participants contended that traditional authorities have local powers to affect FRM.

Table 9 Potential key stakeholders of FRM of traditional authorities

Potential key stakeholder in FRM	**Tasks of FRM**		
	Risk analysis	Risk evaluation	Risk reduction
Members of Parliament and assembly areas	Research, documentation and monitoring	Evaluation of flood risk	Members of AMA metropolitan disaster management committee
Ga Traditional authorities (Ga Traditional Council of Chief, local chiefs)	Research, documentation and monitoring	Evaluation of flood risk	Lease lands to developers, offer shelter to flood victims, party to public education flood risk;

Source**:** Modified from NADMO, 2010.

Table 9 shows the results of potential key stakeholders of FRM of traditional authorities based upon the conceptualisation of FRM task in Section 2.1.3.

Indeed, some of the interview participants argued that local chiefs and landowners regulate land-use and provide safe havens and land for resettlement of victims of flood:

> Local chiefs are major players in regulating land use and also providing lands and safe havens for sheltering flood disaster victims. They also constitutes channels of

> educating the public through durbars and festivals on disaster risk in general (AMC, 11th September 2014).

The role of local chiefs in FRM through public education and emergency shelter was evident in this study.

The research participants contended that traditional authorities are legitimacy as to affect FRM in communities in Accra. The authorities can contribute to decision making on FRM at local government level if they are given opportunity to do so. However, some of them have mixed opinions about the traditional authorities' power in such a seeming secular society like Accra. It is noted that:

> Well it is easier to work with the chiefs in the communities because the people are closer to the chiefs, but Accra has become more cosmopolitan and the regard for chiefs is not really there, so you need different strategies to deal with different circumstances. And larger communities like Accra and that thing you need simply to really have education but there should be a strong enforcement of the law. In small communities where people look up to their chief, there is more respect for the chief then the issue of dialogue and talking over the matter of flood management really helps (WVI respondent August 2013).

Opinion leaders seem to affect FRM indirectly as they are representative of the general public, through using their political clout to convince citizens about flood risk. Leaders of political parties in power or opposition may also influence individuals of flood prone neighbourhoods in abiding by FRM measures. Their activities in disaster management are visible in the disaster management in general and flood risk for that matter. For instance, the research participants expressed some confidence in the traditional authorities' competence to support the implementation of government policies if given the mandate:

> I think the chiefs can help when they are aware of the policies put in place by the government to prevent floods. If they are not aware, how can they help or support or even monitor the major causes of floods in the city. For instance if they are made to know that areas liable to flood should not be sold to private individuals, they would not do that (LTA representative August 2014).

Further, it was argued that opinion leaders collaborate with chiefs with regard to development issues affecting their communities:

> Yes we do and here we have what we call the Old Fadama Development Association and we collaborate with them most at times. We also have the opinion leaders who are mostly the chiefs of different tribes in this community. Whenever it comes decision making we are all come together to work out whatever we have in our mind (OFA representative, August 2014).

Local chiefs and community developments associations seem to be connected in communities of the study site and can affect FRM. Old Fadama is one the biggest slums in the city that is frequently affected by floods and challenged by threats of eviction or relocation. Chiefs and community development associations affect FRM by resisting relocation and eviction programmes. Local chiefs and land owners provide lands relocation and also take part in publication on FRM. They additionally provide shelter and relief for victims of flood disasters.

4.3 Selection of key stakeholders of flood risk management in the city of Accra

Table 10 shows the list of key stakeholder of FRM in the city of Accra. A tick (✓) checks out organisations which are major players in FRM, and were confirmed by participants at the key stakeholder validation workshop as key stakeholders who are directly involved in FRM at the city of Accra. A major player describes organisations that significantly affect FRM process in terms of analysis, evaluation and reduction of flood risk. Key stakeholder must have major effect on preparing or implementing FRM plans of AMA. An organisation needs to be involved in FRM with high legitimacy, role and influence before it is considered in the final list. Urgency is important, but not as crucial as the legitimacy, role, and influence, which are required by an organisation before consideration in FRM. First, an organisation needs a legal mandate to make a claim in FRM (legitimacy). Organisations are required to play major role in FRM with direct significant effect on preparing or implementation of FRM plan of AMA. A major influence can be positive or negative.

Stakeholder involvement in disaster management committee (FRM body) of AMA is important but not crucial in the selection and validation of the key stakeholders. This is because it was realised that some organisations are not represented on the list of committee members but are key stakeholders by virtue of their legitimacy, roles and influence in FRM.

Table 10 Key stakeholders of FRM in the city of Accra

Key stakeholder of FRM	Legitimacy	Role	Influence	Urgency
UNDP	✓	✓	✓	✓
Security Agencies (Military, Police and Fire Service)	✓	✓	✓	✓
Ghana National Ambulance Service; St. Johns Ambulance Services	✓	✓	✓	✓
Ghana Meteorological Agency	✓	✓	✓	✓
Hydrological Services Department; Architectural and Engineers Services Limited	✓	✓	✓	✓
National Disaster Management Organisation - Urban Search and rescue; Relief and Reconstruction, and Hydro Meteorological Disaster Unit.	✓	✓	✓	✓
National Security	✓	✓	✓	✓
Environmental Protection Agency	✓	✓	✓	✓
Accra Metropolitan Assembly:	✓	✓	✓	✓
Town and Country Planning Department	✓	✓	✓	✓
Urban Works Department	✓	✓	✓	✓
Drains Maintenance Unit	✓	✓	✓	✓
Waste Management Department	✓	✓	✓	✓
Ghana Health Service, Public Health Directorate	✓	✓	✓	✓
Metropolitan Disaster Management	✓	✓	✓	✓

Key stakeholder of FRM	Legitimacy	Role	Influence	Urgency
Committee				
Information Service Department	✓	✓	✓	✓
Community Development & Social Welfare Department	✓	✓	✓	✓
Accra Metropolitan Security Council	✓	✓	✓	✓
World Vision International (WVI),	✓	✓	✓	✓
St. John's Ambulance,	✓	✓	✓	✓
Disaster Volunteer Groups (DVGs)	✓	✓	✓	✓
Ghana Red Cross and Crescent Society (GRCS), ,	✓	✓	✓	✓
Religious groups	✓	✓	✓	✓
Human Rights Activist Groups	✓	✓	✓	✓
Zoomlion Ghana Ltd.	✓	✓	✓	✓
Architectural and Engineering Services Ltd. (AESL)	✓	✓	✓	✓
The press (media) houses (e.g. Ghana Broad Casting Cooperation; private print and electronic media)	✓	✓	✓	✓
Members of Parliament and assembly members	✓	✓	✓	✓
Ga Traditional Council of Chiefs (local chiefs)	✓	✓	✓	✓
Slum Union of Ghana, Old Fadama Development Association	✓	✓	✓	✓

Source: Fieldwork 2014. Tick (✓) refers to confirmed key stakeholder organisations

For instance, local chiefs, slum union of Ghana and Old Fadama Development Association are not members of the committee; however, they contribute significantly to FRM. It must be noted that key stakeholders in FRM may have overlapping roles. Organisations from international, national (e.g. presidency, national security, ministries and agencies) affect FRM in Accra but not in sense of key stakeholders as applied in this research.

Stakeholder validation workshop confirms the list of key stakeholders in FRM using attributes of legitimacy, role, influence, and urgency. The participants were twenty one and grouped into three. Each group was given a separate fact sheet to identify and validate key stakeholders on the list. One of the groups' fact sheets was collected at the end and the groups collectively confirmed the final list of key stakeholders, their roles and influence as shown (Table 10). A unique character of most key stakeholders is that, they belong to disaster risk management committee of the Accra Metropolitan Assembly as well as technical development planning committees on the city of Accra. It was also confirmed that there are other stakeholders that are do not directly influence FRM. These categories of stakeholders can be described as non-key stakeholders on the city level of Accra.

It is important to note the degree of involvement of the key stakeholders in FRM is differentiated as they perform different functions in response to flood risk. Some stakeholders only perform emergency response; others are involved in post flood event response activities.

4.4 Description of the key stakeholders of flood risk management in the city of Accra

Results of the stakeholder validation workshop indicate that most international organisations are not key stakeholders of FRM in the city of Accra, except UNDP. UNDP is involved in FRM at the city level. It has legitimately played a major role in preparing the Metropolitan Disaster Management Plan 2010 for the AMA. This plan currently steers the FRM in the city of Accra. It was explained that participation of international organisations in FRM is clear in disaster management committee at the national level but not on AMA level. The organisations were also involved in FRM in

AMA in response to disasters (NADMO Act 517, 1996; NADMO, 2010: 24-25). FRM goes beyond response to disaster to include a continuous process of analysis, evaluation and reduction of flood risk. They are not members of the AMA disaster management committee and the role they play in FRM is more voluntary than mandatory. Nevertheless, international organisations have influence and urgency on risk reduction in the area of relief. They have direct involvement in higher level national FRM body but not on the district level FRM body (AMA disaster management committee).

Participants of key stakeholder validation workshop confirm national level organisations as key stakeholders in FRM in the city of Accra. National level organisations possess attributes of legitimacy, role, influence and urgency in FRM. They belong to the disaster management committee of the AMA and therefore are key stakeholders of FRM in the study site. Findings from the study also confirm that organisations at the national level have legal mandate in FRM (see NADMO Act 517, 1996 of Republic of Ghana). The selected national level organisations in FRM have statutory duty providing their services to the public. Their roles are rooted in the National Disaster Management Organisation Act 517 of 1996 of Ghana.

The National Disaster Management Plan 2010 (NADMO, 2010: 16) on management of hydro-meteorological disasters nationwide also suggests the national level organisations in FRM. The organisations have influence and urgency in FRM. The organisations on national level have influence on preparing and implementing FRM plans. Their urgency in response to disasters is particularly stated in the National Contingency Plan (NCP) 2010 for, pre-flood preparedness, early warning, evacuation, search and rescue, and relief. They further protect life and property during eviction or relocation of developments on flood prone area.

Urgency of key stakeholders in FRM on national level is seen in their contribution to response to flood risk. However, the research organisations such as the Water Resource Commission, the Centre for Scientific and Industrial Research and the universities were mentioned during the stakeholder validation workshop. Research participants argued that the organisations provide scientific knowledge and information on water resources and flood risk but they have not been integral part of

in preparing and implementing FRM the city level of Accra. Their roles seems to be generic and not mainly for preparing and implementing FRM in the study site. Thus, they were not identified as key stakeholders of FRM on the city level. It was contemplated that their activities might be of importance for disaster management and that; they can be major stakeholders in the future.

AMA has legal mandate to deal with disaster of all types in the city of Accra. This power comes from the local government Act 462 and the NADMO Act 517 of 1996.

This mandate as legal recognition is also reiterated in the quotations provided in the section of the assembly's roles, responsibilities and task in the management of disasters in the city. Stakeholder validation workshop confirmed that organisations of AMA in FRM have local government powers and statutory role to prepare and implement FRM plans in the city of Accra. It has responsibility to enforce land-use to influence FRM. The interviews indicate that powers of the AMA allow it to attract support from other stakeholders in FRM. Urgency of the AMA is seen in the support from international, national, NGOs, business and traditional organisations in response to floods. The metropolitan disaster management plan (MDMP) includes FRM. The organisations of the AMA have influence and urgency in FRM. The influence of AMA spans across all policy direction and implementation in FRM. The AMA engages in analysis, evaluation and reduction of flood risk.

Business organisation participation in FRM in the city of Accra is legitimate according the stakeholder validation workshop. Involvement of private companies in FRM is noted in the National Disaster Management Plan and the Accra Metropolitan Disaster Management Plan (NADMO 2010). Again, the National Standard Operating Procedures for Emergency Response (NADMO 2010: 15-18) categorically outline the services and support that can be derived from private companies during emergency disaster response nationwide.

The organisations also play roles in FRM in the form of donations and relief aid for victims of flood disasters. However, the role played in FRM is voluntary and sporadic. The participation is usually requested-driven or based on contract and not on statutory responsibility. Moreover, business organisations are not members of disaster management committee of the AMA. However, business organisations have influence in FRM and they have urgency in supporting FRM efforts of organisations

on district level. Business organisations are not members of the AMA disaster management committee and seem not to be fully engaged in preparing FRM plans although they participate in its implementation. It can be concluded that business organisations are not key stakeholders in FRM.

Involvement of NGOs in FRM in the city of Accra is legitimate. In FRM, contributions of NGOs to FRM cannot be overlooked. The national disaster management plan, the contingency plan and the national standard operating procedures for emergency response and the AMA disaster plan refer to NGOs in their risk management.
The influence in FRM is especially on reduction of flood risk through relief and first aid. The importance of NGO seems is also visible as they attract attention in FRM through the services they offer. However, membership of NGOs in the disaster management committee of AMA is not clear. In fact, the NGOs are not part of the committee. This is also true for community development associations. Participation in FRM is therefore limited to implementation. One can argue that, NGOs at AMA have no mandated responsibility in FRM and their participation is voluntary. Most NGOs are therefore not key stakeholders.

The Accra Metropolitan Disaster Management Plan 2010 indicates that traditional authorities, members of parliament and assembly members have legitimacy in FRM in the city of Accra (NADMO 2010: 18, 25). Traditional authorities are represented by the Ga Traditional Council of Chiefs, and have legitimacy in FRM in Accra. This legitimacy is visible in the Accra Metropolitan Disaster Management Plan (NADMO, 2010: 18, 25). Ga tradition chiefs manage stool lands in the city of Accra. There are also family and private land owners who can affect FRM through land-use and its distribution to developers. Over sixty per cent of land in Accra is owned by traditional authorities and families. Traditional authorities through *Asafo* group control lands in their jurisdictions. Chiefs are major players in FRM through public education, emergency shelter and resettlement of flood victims. Their role in FRM is bound by customs and traditions. They are custodians of people and lands in the traditional areas and therefore, seem to have influence and urgency in FRM. However, traditional authorities are not involved in disaster management committee of the AMA.

The lack of involvement meant that they do not directly contribute to preparation of FRM plans, though they are consulted during implementation stage. It was noted that Ga Traditional Council of Chiefs have local powers to influence FRM. Therefore, it might be important to recruit the Traditional Council of Chiefs into the Metropolitan Disaster Management Committee. However, some interviewees contend that traditional authorities have little control over citizens in cosmopolitan societies such as Accra. The argument is that, local chiefs wield more power in traditional and small communities than in secular societies.

In summary, results on the research question 1 are presented in this chapter. The results refer to the key stakeholders in FRM of the site. The identification and validation of the key stakeholders refer to the attributes legitimacy, role, influence and urgency. With these attributes, different organisations from various levels of governance involved FRM. The findings reveal that the traditional chiefs, referring to the Ga Traditional Authorities, are key stakeholders in FRM. However, they have not been involved in decision-making and planning for FRM of the Accra Metropolitan Disaster Management Committee but consulted at implementation stage. The results on the research question 2 are present in the next chapter.

5 Resilience and anticipation in flood risk management strategies

Empirical findings on resilience and anticipation are presented in Chapter 5. The chapter has two sections. Section 5.1 shows empirical findings resilience aspects in FRM strategies whereas Section 5.2 demonstrates findings aspects of anticipation in FRM strategies.

5.1 Resilience aspects

5.1.1 Resilience aspect *Omnivorousness of the* flood risk management *strategy*

Results on the diversity of response resources and responses to flood risk within and among organisations describe omnivorousness aspect of resilience in FRM strategy.

Indicator *Diversity in sources of response resources within and among organisations*

Data from this study indicate that variety of sources of response resources in the strategies of FRM. The diversity in response resources comes from different international, national, regional, metropolitan, business, NGOs and traditional authority organisations in FRM as indicated by results from stakeholder analysis in chapter 4. This diversity was confirmed by research participants in the interviews. In affirmation, a research participant representing a national organisation in FRM expressed that:

> We work in conjunction with other agencies such as the Fire Service, Police Service, Town and Country Planning Department, National Disaster Management Organisation (NADMO) and utility institutions such as Water Company and Electricity Corporation (Representative of SAF 12th August 2013).

Diversity in sources of response resources in FRM strategies refers to the variety of organisations that respond to flood risk in their respective capacities. Organisations with expertise in security, land-use planning and utility services deal with unexpected flood risks and its impacts. Again, research participants representing the organisations from metropolitan level organisations further affirmed that:

> Any time there is flooding, it's not only the Ministry of Roads and High Ways, the Ministry of Works and Housing, and the Ministry of Local Government helps through

> their other agencies to resolve it. National Disaster Management Organisation has a committee of people from Hydrological Services, Accra Metropolitan Assembly, and others, even the military, even the police are all involved because any time the flood comes they get the military in to do rescue (Respondent of LRD, 20th August, 2013).

Diversity is also in regards to sources of response resources from organisations as in sector ministries, committees of NADMO and AMA in FRM strategies. The organisations engage specific and sometimes overlapping roles in FRM, which are similar to the results from stakeholder analysis in Chapter 4. Whereas the Ministry of Roads and Highways plays role in construction of bridges, culverts and roadside drains, the Ministry of Works and Housing engages with drainage works. These activities of FRM seem to focus on drainage, similar to activities of the Drains Maintenance Unit of the AMA.

Diversity further refers to expertise of actors in FRM which involves policy makers and technocrats. Research participant from NADMO of AMA confirms in the interviews that:

> We have a disaster management committee mandated by the disaster management regulation Act 517, consisting of technocrats and policy makers (Respondent: LND 24th July 2013).

Involvement of policy makers and technocrats in FRM is an indication to variety of perspectives in response to flood risk.

Diversity is shown in several international organisations that are involved in FRM strategies (e.g. United Nations systems; German International Development Cooperation and Japan International Development Agency). This diversity extends to non-governmental organisations including the Red Cross and Crescent Society and the World Vision International, which seem to bring international perspectives to FRM strategies. This international perspective can enrich the diversity that bring national, regional, metropolitan, NGOs, business and traditional authority organisations to FRM strategies. Findings on diversity of sources of response resources seem to confirm findings from stakeholder analysis in chapter 4.

However, diversity of organisations in FRM strategies seem limited to some key stakeholders and excludes others from the committee that prepares FRM plans for

AMA. The Metropolitan Disaster Management Committee of AMA prepares FRM plans and its membership does not include all key organisations of FRM. Research participants expressed in the interviews that:

> Local chiefs are not involved in stakeholder meetings during the decision making phase for FRM (Respondent of LND 24th July 2013).

Local chiefs represent traditional authorities, flood-prone community, and seem to be key players in FRM, but have not been constituted in the FRM committee. The empirical data show that local chiefs are custodians of land and people in traditional areas. Chiefs have traditional leadership to affect FRM strategies through local community expertise and land-use. Local community land ownership is over 50% in Accra, which affects land-use and distribution for development. This position makes them power brokers of land use and distribution. Chiefs represent communities and can directly influence FRM strategies.

Furthermore, community development, business, and activists organisations that are major players in FRM can also enhance diversity in FRM strategies.

Indicator *Diversity of responses within and among organisations*

Interviews from this study refer to diversity of responses in organisations of FRM strategies. Diversity of responses in FRM strategies is seen in multiple organisations responding to flood risk in various capacities. Research participants refer to diversity of responses in organisations of FRM strategies in the interviews:

> Mostly, we are into construction of channels. We open up the channels so that there will be free flow of water from the communities into the sea. Again, we are also putting in place some other management strategies such as water retention ponds and then detention ponds because we have realised that drains alone will not be sufficient so we have included now retention ponds and detention ponds to be able to manage flooding in the city of Accra. We are also involved in the protection of the coastline (Respondent of SHS, 31st July, 2013).

> Apart from this general public education, we have got flyers about disaster risk reduction that we give out. We have one on floods. We have one on CD with music and this is usually played on television. Now we are embarking on a school programme called catch-them-young. …we are forming disaster risk reduction clubs in schools. We do this in second cycle institutions because these young children

> could be educated to grow with the ideas. Every report on fire outbreaks or any disaster risk, we send the letter to Metro coordinator identifying the venue and the topics of the programme to be discussed. Disaster risk reduction is not a routine process only, a firefighting strategy is sometimes necessary (Representative of LND 24th July 2013).
>
> If you look at the city previously we did not have dust bins like we have in areas where cars will come and pick refuse but we are being introduced now. We have these Zoomlion and other companies that now pick these refuse and I think those are the things and I think it has reduced greatly (Representative of LRD16th July 2013).

The quotations demonstrate that FRM strategies include drains and detention ponds. Although these are structural measures aiming at controlling floods, they address the problem from different approaches with the same objective of reducing risks of flooding. Whereas channels retain and direct flood waters into the sea, the water detention ponds serve as temporal reservoirs for retaining flood waters when channels overflow. The sea protection walls attempt to reduce tidal flooding and its potential impacts.

Moreover, it is apparent that FRM includes prevention of flood hazards and protection (regulation) of flood vulnerability, which can contribute to reduction of risk. Visible approaches include construction channels as well as management of waste through clean-up exercises to facilitate flow of floodwaters. Related to the findings from stakeholder analysis in Chapter 4, multiple organisations play different roles in FRM. Attempt to deal with courses of flood disasters through waste management involves multiple organisations. Private and local government organisations remove waste and silt in drains. In flood event management, various responses of rescue and humanitarian relief come from multiple organisations, governmental and non-governmental organisations in FRM strategies. Emergency health relief and evacuation also have similar story as the Ghana Ambulance Service and St. Johns Ambulance Service offer similar services. Accounts of this could go on and on again. In summary, interviews show both structural and non-structural measures of FRM strategies that suggest diversity of response resources.

However, the shortfall exists in the diversity of the structural and non-structural measures. Structural measures seem to have prospects for advancing a resilience response strategy. Result show inadequate, narrow and drains choked with garbage.

Interviews also suggest that there is inadequate land to construct new drains and flood detention ponds. The shortcomings suggest that existing strategies cannot contain any slightest increase in floods. Besides, internet and mass mobile phone text messaging as a means of communicating flood risk to the public seem to be limited in FRM strategies. There is a website, which is not well developed as an effective interaction medium for flood warning, currently.

In summary, the empirical findings show diversity in sources of response resources and responses in organisations of FRM strategies as indicative of resilience. However, local chiefs, business and private development organisations seem not to be involved in disaster management committee of AMA, which can undermine diversity in FRM strategies.

5.1.2 Resilience aspect *Agile and timely flow of response rate of the flood risk management strategy*

Interviews for this study show indicative description of agile and timely flow of response in organisations of FRM strategies. Empirical findings are presented as follows.

Indicator *Real-time monitoring, forecasting and warning of flood event within and among organisations*

Research participants demonstrate in the interviews that there are indications in FRM strategies that seem to facilitate real time monitoring, forecasting and early warning of flood risk and impacts. Research participants explain that indications in support for timely response to unexpected flood disasters exist:

> A 24-hour system of communication exists between this unit and other units in the military as well as other security agencies and stakeholders of FRM in Accra. In operation rooms, emergency flood disaster event is monitored through radio stations and reports from meteorological stations. We have team for recognisance survey – at least four teams and more teams and vehicles are released for response to flood disaster risk (Representative of SAF, 12th August 2013).

> The national disaster management organisation (NADMO) is always here 24/7 to attend to hazards and disaster risk in Accra. We have Urban Search and Rescue Team of NADMO, always available 24 hours daily with their siren. They are military

> trained staff of NADMO. They have a vehicle that run and with siren. It is custom-made vehicle that runs fast (Respondent of LND 31st August 2013).

The quotations suggest that organisations in FRM strategies have systems in place to monitor and communicate flood risk for immediate response. Establishment of operations units helps to monitor and communicate flood risk daily and nightly seems to be crucial. Establishment of joint-team of security agencies and the urban search and rescue further suggests readiness to deal with unexpected flood disasters. A hotline telephone number is available for reporting risk information to the disaster management operation rooms from the public. Special telecommunication, pager popularly called Global open Trunking architecture (GoTa), links the security agencies during flood events.

Interviews further suggest that there are vehicles to move to disasters scenes. Respondent from national security organisation argues asserts that:

> We have enough vehicles, now I can tell you my unit alone we have more than ten vehicles. At a certain point in time, police administration did not have up to 100 vehicles nationwide but now we have enough vehicles. In my unit, I have at least ten fast running vehicles (Representative of SPS, August 2013).

The results also show that security organisations in FRM strategies have means to monitor developments and exchange information on flood risks and impacts. Findings also suggest that national security organisations have vehicles to move personnel to respond to flood risk and impacts.

Contrarily, research participants demonstrate in the interviews that some organisations in FRM strategies seem not to be resourceful enough for agile and timely flow of response rate. In particular, the interviews show that organisations from national and district (AMA) levels are poorly resourced for real-time monitoring, forecasting and warning in organisations for quick response to unexpected course of flood disasters. As illustrated, research participant representing organisation from national level argues that St. John's Ambulance had only one ambulance, which was broken down:

> As I am talking with you now, we have only one ambulance and it is not in good condition. I have written a letter to send it to workshop for total overhauling. Can you imagine? So if any disaster happens between now and the next one or two weeks,

> we would not be able to move with an ambulance (Representative of NJA, July 2013).

Ambulance is necessary for providing first aid support and emergency relocation of flood victims to health facilities, and plays important role in agile and timely flow of responses response. Other organisations do not have financial capacity to procure required equipment or technology for real-time monitoring, forecasting and warning of flood events. Research participant from NADMO argues in the interviews that:

> One area is the reconstruction, which is where we have a problem. We need to respond quickly to flood disasters but at times we unable to do that because of lack of logistics. We need to move a rescue team to a disaster scene that we may have disasters spreading all over the place, but we have limited resources. So where do we go? (Representative of LND, August 2013).

Furthermore, representative of weather forecasting organisation argues that there is inadequate technology to give accurate, timely and a one-week lead-time weather reports:

> One major problem is that Ghana Meteorological Agency does not have a model for weather forecasting. We need to run a weather forecasting model, which can give us a forecast up to seven (7) days (Representative of SMA, 31st August, 2013).

The quotation suggests that weather forecasts and early warning of flood events hardly come true. The forecasts and early warnings of flood disaster also come too late. As a result, many people do not take the publicity seriously. Moreover, flood forecast and early warnings with short lead-time do not allow preparation in response to flood risk and impacts.

Interviews further establish that real-time monitoring, forecasting and warning of floods may be offered but actors of organisations cannot get to flood disaster scenes for timely response. Research participants argue that physical structures and traffic jams on roads delay actors of organisations from getting to critical flood-prone zones on time:

> Ability to move from the unit's base to the disaster site is usually obstructed by road users and structures. Both vehicle drivers and pedestrians do not respect the sounding of our sirens. Structures are sparsely built and this obscures the movement of the rescue team. Accessibility to the area of disaster is sometimes impeded due to

> bad roads and the inability to manoeuvre (Representative of urban search and rescue operations, 31st July, 2013).

Similarly, another representative from national security organisation explains that:

> When it starts raining now, you know in Accra, in 30 minutes, rain can come heavily meanwhile our patrol team would be patrolling very far away so we have to call them back and it takes time for them to return which is a problem for timely response. One other problem is the police personnel who are supposed to help respond to flood risk are not located at one place and so if they are not around when flood occurs it is difficult to bring them together for timely response to emergency flood risk (Representative of SPS, August 2013).

These conditions debilitate capacity of response organisations for real time monitoring, forecasting, early warning and agile response to unexpected course of flood disasters. The challenges delay mobilisation of personnel and material resources for quick and timely response to unexpected course of flood disasters.

Real-time monitoring, early warning, and forecasting of floods can be useful for agile and timely flow of response resources of organisations in response to unexpected course of flood disasters. Timely response to rescue of life and property could delay without real-time monitoring, early warning, and forecasting of floods. Empirical findings indicate that security organisations have resources for quick and timely response but movement to flood disaster sites is obstructed by traffic jams and physical developments. However, resources monitoring, forecasting and early warning of floods seem to be inadequate for organisations that play these roles.

Indicator *Decentralised availability of response resources within and among relevant organisations*

Decentralised availability of response resources to organisations was mentioned in the interviews as an indicator for agile and timely flow of response rate of organisations to flood risk. The empirical findings show that international and national security organisations have adequate response resources for dealing with the course of flood disasters. In line with this assertion, argues in the interviews that:

> We always have a standby force for a quick response. Our personnel are trained to search and rescue in all fields of disaster and a joint group of these trainees are dispatched to disaster scenes during emergency. The rapid response team is ready

> as flood disaster risk requires immediate response (Representative of SAF, August, 2013).

For immediate dispatch of emergency response team to search and rescue life and property in floods, results indicate that personnel and vehicles in security organisations are available. In relation to the role of the security organisations towards life and property indicated by the stakeholder analysis in chapter 4, availability of response resources to the organisations for FRM is considered crucial. Moreover the roles of the organisations are linked to obvious threats to life and property from floods.

On the contrary, research participants in the interviews indicate that some organisations, especially from national, district and non-governmental bodies do not have adequate response resources. Representative of organisation from the AMA explains in the interview that:

> Sometimes the funding comes a little too late. So it is not a country where we can have all logistics and readiness for action like elsewhere in other developing countries (Representative of LRD, August 2013).

Response resources are crucial and need to be available in time to enable actors of organisations to formulate and implement FRM strategies. Resources, referring to personnel, technological and funding, can advance organisational capacity to deal with unexpected courses of flood disasters.

Interviews further indicate that NADMO, which coordinates all stakeholders for FRM, faces financial challenges and finds it hard to procure stockpiles for dealing with the course of flood disasters. Due to financial deficits, NADMO cannot sustain some members of DVGs who may need money to survive. Research participants confirm the financial constraints in the interviews as demonstrated in the following quotations.

> The national disaster management organisation cannot even move if they don't have the resources. National disaster management organisation has not received its budget for the year, so even in mixed operational and simple administrative work it is very difficult for them (Representative of NWV, August 2013).

> I am the national disaster management organisation (NADMO) coordinator for the Accra Metropolitan Assembly, as of now I do not have relief items stocked here. For

> example on the 26th October 2011, the flood affected 25,000 people but we could only provide items for 5,000 plus people; so the rest were left unattended to. The vehicles are not available for our people to be transported to across the city to educate the public. (Representative of LND, August 2013).

Likewise, some of the non-governmental organisations have financial challenges to sustain their volunteers:

> We have no financial means to sustain our volunteers in the organisation. We do not pay them because we have no money to do so, retaining is difficult (NJA Representative, August 2013).

The quotations seem to suggest that inadequate finance is chronic and this negatively affects the ability of organisations in FRM to procure relief items and vehicles for responding to unexpected course of flood disasters and impacts. Resources are particularly crucial for implementation of FRM plans. In reference to results from stakeholder analysis in chapter 4, many organisations play various roles in FRM and require resources to accomplish such responsibilities. One can argue that, the lack of finance can disrupt ability of organisations play their roles in FRM.

Indicator *Arrangements for continuous cooperation within and among organisations for rapid response*

Research participants in the interviews mention that, arrangements for continuous cooperation for rapid response refers to networking and sharing of information among organisations for rapid response to flood risk. Research participants indicate in the interviews that actors representing organisations in FRM communicate via pager, security radio, e-mails, NADMO website and meetings. Continuous cooperation of organisations also includes establishment of operations centre for monitoring and responding flood events. It was learned from interviews with research participants of this study that:

> Radio room is always available for regular communication of risk information to the operation centre. At the disaster scene, all security agencies (the military, fire service, police, and NADMO operation unit) meet to establish a field operation centre for coordinating emergency response resources to save life and property (SAF August, 2013).

> Especially at meetings, we shared ideas and the politicians are taking them. The politicians are taking the ideas but other factors may hinder implementation of such ideas (SPS, August 2013).

> There was a meeting we attended and all the metro directors were assigned to go to their communities to identify all drains that pose threats to life and property. These drains were identified and when we the Accra Metropolitan Assembly could not work on, they were awarded to contractors and de-silting is going all over the city (LND, August 2013).

Meetings for directors of organisations and technical committees are the main platforms for learning and exchange of ideas about FRM. The Metropolitan Disaster Management Committee of AMA provides a useful platform for sharing information on FRM. NADMO has hydro-meteorological disasters and relief and reconstruction committees that contribute to FRM. Organisations of FRM cooperate through meetings and visit to flood-prone communities in Accra to assess flood risk and impacts. Memoranda, e-mails, phone calls and reports further facilitate networking of organisations of FRM strategies in the discharge of their duties.

For continuous network with the public, DVGs as well as print and electronic media provide early warning information for FRM. DVGs provide early warning information from house to house. Electronic media include local radio stations, NADMO website and television broadcasting. Print media consist of FRM brochure, flyers and information van with public address system. Activity-based involvement of the local communities is done through community clean-up exercise, annual national and regional disaster management platforms and durbars for disasters risk reduction. However, the results of the research show that the district disaster management platforms for FRM are not established yet but they are the next agenda.

Inter-organisational training and exercises for emergency response to food risk further facilitate cooperation of organisations of FRM. NADMO organises scenario-based exercises and refresher courses actors representing organisations in FRM. International experts are invited annually to retrain the staff of the organisations. Research participant representing a national organisation in FRM confirms the inter-organisational training for FRM in interviews that:

> We do periodic training alongside with NADMO allied institutions to be battle-ready. Hence our focus is not only into rescuing people but also property. In a nutshell, we

> are part of the actors involved in in disaster management (Representative of SAF, August, 2013).

This statement does not only support the idea of common training but also training that aims at making responders ready to deal with emergency situations when floods occur. The arrangement for cooperation in FRM seems to bring stakeholder of FRM together as already indicated by results from stakeholder analysis in chapter 4. However, cooperation regarding implementation of FRM plans and maintenance of drains before flood event seem to be poor as results from stakeholder analysis suggest choked drains, resistance to relocation, and encroachment on waterways by developers.

Indicator *Flexibility in rapid response of FRM strategies of organisations*

Research participants explain in the interviews that there is flexibility with mandate to for organisations to respond flood risk and impacts, especially during flood disasters. Research participant representing organisation of FRM from national level explained in the interviews that:

> Per our training, we are supposed to be proactive. There is no bureaucracy in the military. We respond to flood risk and later report to or debrief our supervisors instead of calling for instructions from them before responding to disasters. Bureaucracy does not facilitate timely response so it is avoided in our response action strategy. Sometimes, members of local community calls to report and we pass on the information for action. The problem, issues of flood disasters and recommended actions are reported (Representative of SAF August 2013).

This arrangement is to ensure that there is no delay in response to flood disasters. However, the situation looks different in decision making and implementation of FRM before flood event where emergency response and security rudiments are not applied. There are delays in decision making, implementation and release of funding for FRM which seem to frustrate immediate response to flood disasters and impacts as results from stakeholder analysis in chapter 4 suggest.

Delays in FRM occur in various ways. Results showed that delays occur in taking responsive action to mitigate hazards and vulnerabilities of floods after flood risk assessment. Flood risk assessment in the city of Accra takes place quarterly in a year. Annual reports on the assessment are also submitted early January each year. Reports from AMA are submitted to Greater Accra Region and then organisations in

FRM at national levels where a composite one is compiled and submitted to the Ministry of Interior. Sometimes, from the Ministry of Interior, reports go through presidency, cabinet and parliament for approval and actions.

A team of experts identifies flood hazards and physical structures in watercourses and then report to the city authorities for mitigation action to be taken. In situations where a lack of resources causes delay in responding to determined flood hazards and vulnerabilities, the risk of flooding may accumulate and escalate beyond manageable levels and strengths of the organisations involved. In particular, increase in the expected flood risk that has not been attended to can degenerate into unexpected flood disasters.

In summary, empirical findings show indicators and identifiers describing aspect of resilience regarding agile and timely flow of response rate of the FRM strategy. However, inadequate resources, especially technology for reliable monitoring, forecasting, and early warning floods hinder agile and timely response to unexpected course of flood disasters. Further, poor arrangements for cooperation in implementing FRM plans before flood events, lack of readily available funds for organisations of FRM and delay in decision making in mitigation of flood risk also stifle agile and timely response of organisations in FRM strategies.

5.1.3 Resilience aspect Homeostasis *of the flood risk management* strategy

Expressions from the empirical findings describe homeostasis aspect of resilience in FRM strategies. These findings are categorised under the indicators of the homeostasis aspect of resilience.

Indicator *Awareness about unexpected course of flood disasters within and among organisations*

Research participants expressed in the interviews that actors from organisations of FRM are aware about unexpected course of flood disasters within and among organisations which refers to homeostasis aspect of resilience in FRM strategies. While interviewees agree on awareness about unexpected course of flood as indicator of resilience, there is disagreement on its relevance in the cause of flood disasters since expected features of flood risk have not been addressed in the study site. For illustration, a representative of organisation of FRM from national argues in the interviews that:

> Flood disaster risk is not really an issue of unexpected. Unexpected could have been related with breakdown of dams but dam breakdown is not an issue of the Accra floods….What leads to excessive flood, for instance, is encroachment of watercourses and choking of drains which could divert flood waters from known water channel thereby causing floods. If encroachment and filling of drains with garbage can be stopped, sudden flood impacts can be reduced (Representative of SAF, August 2013).

Again, research participant adds that:

> The police service is aware of the flood spots in Accra – Alajo, Weija, Dansoman, Alavanyo et cetera. … We always prepare for more responsibilities in flood instances. So we have all those flooded and we have many places flooded, we divided ourselves and go. So we always anticipate that there will be a point when we will have more than three, four, five locations which are flooded at the same time (Representative of SPS August, 2013).

Moreover, interviewee further refers unexpected course of flood disasters to climate change and increase in number of areas affected by floods:

> We know the flood-prone areas and we know the high risk areas we know them within the city and even in the suburbs we know them. We have been working in these areas for a long time and so we know which areas are high risks, medium and then low risk areas so we know them. Climate change is one major effect of unexpected flood risk in Accra because the climate changes, rainfall intensity has increased and so on. The greatest of the problem is the size of channels and bridges. A lot of the drains and bridges have not been built or designed by hydro department and also a

lot of them too have been done when those areas were underdeveloped settlements (Representative of SHS August, 2013).

Unexpected course of flood disaster was attributed to siltation of Odaw drain in the study site:

> We as city authorities know that our biggest problem of flooding is the silted Odaw channel. Unless we get the Odaw channel running, this incident of flooding will always remain with us (Representative of LRD, 2013).

The quotation suggests that unexpected course of flood disasters are likely to occur in known flood-prone areas.

In addition, research participants refer to past experiences and uncertainty about time of occurrence of flood events and impacts to describe awareness about unexpected course of flood disasters:

> The National Disaster Management Organisation (NADMO) knows very well that in Accra, when it rains heavily, areas like Awoshie in Ga South, Sakama and so on, such conditions unknown blockade of watercourses, people trap in structures and carry away by floods could happen. On 26th October 2011, flooding overwhelmed us. It rained overnight and was not something we had anticipated. But you see it was as a result of the negligence on the part of the residents. People throw refuse into drains, and build on waterways which block waterways (LND, 2013).

Past experiences from flood disaster patterns also give lessons to the stakeholders that it is not all the flood risk and impacts that can be determined. Usually, flood is expected in rainfall seasons but it occurs outside known rainfall season. A respondent asserts that:

> We are very much aware of the possibility for unexpected course of flood risk. We are made aware mostly through the meetings we have with other stakeholders and from historical experiences. From historical perspectives, we know that whenever it is the rainy season, floods are likely to happen and not all their impacts can be pre-determined as in general disaster situations (Representative of NJA, 2013).

The results of the interviews showcased an awareness of the possibilities for the occurrence of flood whenever there is a rainfall.

It was further explained that there are mechanisms in place to respond to sudden occurrence of floods:

> We are aware that at any point in time there will be that likely flooding so we always prepare ourselves to face the challenge. So the military is brought in because we received SOS message that tells us that the flood level is such that we need to send live boats to such areas (Respondent of LND, August 2013).

The data obtained show that advanced logistics for monitoring and forecasting of near-accurate weather warnings are unavailable. The following quotation as an instance of the research participants' expressions on this point contends that:

> Until 2012, Ghana Meteorological Agency was always relying on satellite images to give weather warnings. … One major problem is that GMA does not have a model for weather forecasting. We need to run a weather forecasting model which can give us a forecast up to seven days. So that when it gives us a forecast up to seven days, then we keep monitoring and updating those forecasts with ground truth (A representative of GMA August, 2013).

The quotation shows that organisations do not have the requisite technology and logistics capacity to predict flood events in advance. This is related to results from stakeholders that explain the inability of organisations of FRM to deal with flood risk.

Results further indicate that the public education media also helps dissemination of flood risk information and awareness about unexpected course of flood disasters:

> …like the awareness creation platform that NADMO created, flood risk information is published in the newspapers and it is about creating awareness of disaster risk management. We give money also to pay for radio stations or TV stations to create awareness of flood disaster risk. So we are involved in the education and we strongly believe that the education is the most important way to let the people also be part of disaster management (WVI representative, August 2013).

Findings further indicate that actors FRM become aware of unexpected course of flood disasters through meetings and field trips:

> What we called flash points are where the flooding occurs frequently most so we our attention is always on such areas. We study the flood trends and the factors very carefully over the years so we can predict that if we do not remove this waste or de-silt drains or destroy or demolish these structures on the waterways which cause

> floods. That is why the Accra Metropolitan Assembly has been doing the demolishing exercise. Our staff goes round to search for such structures and then inform the appropriate departments. We have directors meeting every fortnight and discuss these things with the mayor as chairman. We do what we call fieldtrips and observe the factors and flashpoints of floods before we take action (Respondent of PHD, August, 2013).

Actors of FRM assess patterns of flood risk and flood events. Visits to flood-prone communities enable actors of FRM to identify flood hazards and vulnerabilities and keep track of on flood risk.

Research participants further explain in the interviews that, there is awareness about unexpected course of flood disasters but a required strategy to deal with the problem remains ineffective. In support of this view a representative of a traditional authority argues that:

> The people are always aware of flooding in Accra because they know it is an annual phenomenon. But in terms of putting down the required strategy to curb the flood, they do not do that effectively. They wait until the floods come before they start acting. Because people choke the drains and build on water ways, we have the floods happening most at times even when it is not in the rainy season (Representative of LTC, September 2014)

In summary, results indicate that there is awareness of unexpected course of food disasters and there are media through which actors of organisations share knowledge about flood risk. Unexpected course of floods, therefore, seem to be explained by major and sudden flood events, breakdown of dams, major flood events as well as encroachment of waterways by settlers and blockage of drains with debris. Results also indicate that awareness about hotspots of flood risk can inform actors of FRM where unexpected flood disasters may occur. Awareness of the inadequate size of bridges and drains was also noted as a potential caveat for unexpected course of flood disasters.

In addition, lack of resources for accurate weather forecasting, recording of flood levels and advanced reporting of flood impacts are a challenge to awareness of unexpected course of flood disasters, especially during flood events. Hydrological Services Department monitors and records volume of flood water and Ghana Meteorological Agency reports weather flood events to the public through the media

houses and NADMO. However, these organisations have inadequate resources for monitoring flood events.

Indicator *Coordinated learning about previous flood risk management performance within and among organisations*

In the interviews, research participants refer coordinated learning about performance of organisations in FRM strategies as indicator of homeostasis aspect of resilience. Coordinated learning platforms of organisations in FRM include NADMO technical committees, workshops, and joint activities.

Empirical findings indicate that organisations of FRM learn through partnerships and coordinated activities of NADMO. Partnership among organisations through coordination was indicated in the interviews as the following quotations explain:

> We partner very well with our other developmental agencies. Coordination is in the domain of NADMO and other organisations so we are brought on board because of health risk and impacts of flood. We are not working in isolation that is why there is the fortnightly directors meeting at the assembly where all these experiences are shared (Representative of LHD, August 2013).

> NADMO has the official mandate for coordination so we get information from them. Even though, we take our own initiative, we listen to NADMO for response information otherwise there will be chaos during emergency response (A representative of NJA, August 2013).

> Stakeholders attend management meetings organised by NADMO to exchange information about their experiences from responding to flood disaster risk. Information from district levels leads to demolition exercises. In fact various institutions team up to act and this put pressure on the relaxed institutions to do their work within the demarcated area and deliver justice without human face (Respondent of SAF, August 2013).

Results from stakeholder analysis in chapter 4 further show that coordination role of NADMO helps to mobilise resources for FRM.

Research participants explain further that coordinated learning is seen in joint clean-up activities of organisations in FRM. In the interviews, representative of district organisation explains that:

> We partner very well with our other developmental agencies. We encourage clean up exercises from house to house. We use the assembly members to sensitise the public. In Accra here we have a law that says last Friday of every month; everyone has to come out to clean his or her environment (Representative of LHD, August 2013).

The interviews also show that experience with floods resulted in further action to mitigate flood risk in Accra. Research participants from the AMA confirm actions to mitigate flood risk and the following quotation illustrates:

> The last time we had a major flooding was in October 2011, which in short caused a lot of havoc including the loss of lives and all that. And since then the AMA has been putting certain strategies in place to alleviate the problem. That has resulted also in the coming out of Conti Project (*The Accra Sanitary Sewer and Storm Water Drainage Alleviation Project in Accra*)**,** to dredge the major lagoons that we have within or the major water bodies that we have within the Accra Metropolis. Also, the project is to construct new storm drains and rehabilitate the existing ones. This Conti Project is as a result of the issue of perennial flooding we have been having in the city of Accra. And it is very comprehensive in scope because it is going to tackle so many issues that we have been grappling with for some time now (Representative of LRD, August 2013).

The quotation explains that coordinated learning and collaboration of organisations support decision-making in response to unexpected flood risk.

Empirical findings show that technical committees are platforms for coordinated learning in FRM. Hydrological meteorological disasters committee of NADMO brings representatives of organisations in FRM to share expertise and information about flood risk. Members of the committee share their experiences of past performance in response to flood disasters to inform new FRM strategies. As an illustration, a research confirms that:

> In fact at the level of Hydro-Meteorological committee, FRM information is shared. Because there are agencies from different departments, so we share a lot of information. We have meetings where all organisations convene to discuss flood disaster risk in Accra. Now the city, and even the district assemblies have development committees and the hydrological services department serves on those committees as well as the Town and Country Planning Department. What hydrological services department is doing as a way of mitigating floods, we bring that to the table, all our projects we do for the year we bring it to the table and other

> agencies also bring theirs to the table at that particular central point, it's been done now (Representative of SHS August, 2013)

However, Ga traditional authorities, flood-prone community development organisations and slum union of Ghana do not belong to the committee. The organisations are only consulted when needed. Research participants illustrate that excluding main organisations from the committee is not a sign for effective collaboration FRM strategies. Research participant from Ga traditional council illustrates in the interviews that:

> Information dissemination on flood risk has also been very poor. People only have information after the flood incidence and since there is low collaboration, we have the situation compounding every year. The authorities only come to us when they need lands for developmental projects. That is when you see these authorities sending letters to us or using other media (Representative of LTC, September 2014).

Again, research participant from the Slum Union of Ghana explains that:

> I am not aware of the Accra Metropolitan Assembly Disaster Management Committee and I have not been to their meetings before (SUG representative September 2014).

Findings indicate that the Ga Traditional Authorities, Slum Union of Ghana and Old Fadama Development Association are not members of the AMA disaster management committee. However, the results indicate that coordination, collaboration, meetings, and technical committees are main platforms through which organisations share experiences and learn from previous flood disasters. Ga Traditional authorities, Slum Union of Ghana and Old Fadama Association are organisations from flood-prone communities. Absence of these organisations in committee that plans and implements FRM strategies may exclude key players who affect flood risk.

5.1.4 Resilience aspect Flatness of response process and structure of flood risk management strategy

Aspect of resilience regarding flatness of response process and structure of FRM strategy was discussed in the interviews with research participants, and referred to indicators and identifiers for decentralised decision-making and implementation of

responses to flood events and their impacts. Details of empirical findings are presented in the following section.

Indicator *Decentralised decisions on implementation of responses to flood events and their impacts within and among organisations*

Research participants refer to decentralised decisions on implementation of response to flood events and impacts in describing resilience in FRM strategies. Decentralised decisions on implementation of responses to flood risk and impacts have been shown in findings from stakeholder analysis in chapter 4. FRM is decentralised from national, regional, district and sub-district levels to include DVGs in local communities.

The NADMO Act 517 of 1996 indicates disaster risk management including FRM at all levels of government in Ghana. Section 15 of the Act 517 requires all districts to set up disaster management committees to plan for disaster risk management. Furthermore, Accra Metropolitan Disaster Management Plan 2010 contains details of FRM in the city of Accra. The Local Government Act 460 of 1993 of Ghana further mandates local government authorities to manage all development issues within their jurisdiction. FRM takes a form of decentralised governance in the city of Accra.

Again, decentralised responses to flood events and their impacts were expressed in the interviews as indicated in the following quotations. Representative of NADMO at the AMA explains that:

> There was a meeting we attended and all the metro directors were assigned to go to their communities to identify all drains that pose threats to life and property. These drains were identified and when we the AMA could not work on, they were awarded to contractors and desilting is going all over the city. Public get information by print press, electronic media (radio, website, and television), brochure, flyers, music, and information van with public address system, clean-up exercise, durbars, national and regional platforms for disasters risk reduction - no information district platforms (Representative of LND, August 2013).

The quotation implies that decentralised responses to flood risk refer to roles of individuals organisations of FRM. Moreover, decentralised responses to floods is also seen in the platforms for disaster risk management as in national and regional

platforms and public education. Decentralised responses can further be seen in the representation of individual actors of FRM at the technical committees. An interviewee explains that:

> We have FRM committee that is under the NADMO. We call it the Hydro-met committee (Hydro-meteorological Committee). We have committee members coming from various agencies, universities, and all town planning, the agencies responsible for drainage and flood management, and so on. Environmental Protection Agency and so on and I are members of that committee also. We all hold meetings together with the city authorities and we discuss the development issues so that everybody factors into the activities that will have to go on and the issues that will have to be tackled as far as the development is concerned (Representative of SHS, August 2013).

The quotations suggest that organisations of FRM perform different activities in technical committees. Members of the committee discharge their expertise duties in drainage construction, weather forecasts and emergence responses. Research participant further explain in the interviews that similar committees exist at the AMA for FRM:

> We have the disaster management sub-committee who are members of the sub-metros and areas where they come from. They have to look for the flood-prone areas. They identify the areas and then call us. The disaster management committee meets quarterly but the sub-committee meet every month (Respondent of LND, August 2013).

From the quotation, decentralisation extends to committees of the AMA. Decentralisation seems to distribute FRM tasks in identifying flood hazards and flood risk among sub-metro assembly members of the AMA.

In summary, these findings show decentralisation in FRM strategies. It is seen in various mechanisms such as legal mandates and creation of technical committees of organisations in FRM from national and local government levels. Decentralised responses to flood events and their impacts can advance ability of organisations to deal with unexpected flood disasters since tasks of FRM is spread across organisations, not concentrated on individual organisation or at a central point of action.

The next section presents results on redundancy of resources aspect of resilience in FRM strategies.

5.1.5 Resilience aspect *Redundancy of response resources for flood risk management of the organisations*

Research participants illustrate redundancy of response resources in the interviews with reference to resilience in FRM strategies. Symptomatic quotations of redundancy refer to additional resources for response as well as in the design and implementation of risk management measures beyond determined probability of flood risk. Details on empirical findings are elaborated under the following sections.

Indicator *Additional resources within and among organisations*

Interviews refer to additional resources within and among organisations in FRM as indicator of redundancy in response resources. Response resources range from material to information that lay slack mainly for dealing with unexpected course of flood disasters. The empirical findings refer to savings and reserves of organisations; coordination of additional resources; and design of measures and instruments beyond determined flood risks. Identifiers for additional resources among organisations refer to savings and reserves for responding to unexpected course of flood disasters. Savings and reserves are backups for fail-safe response to the course of unexpected flood disasters. Situations beyond normal occurrences may incapacitate the anticipated resources for responding to normal occurrences. Savings and reserves are to insure continuous capacity to deal with emergency when it escalates expectations of responders.

Research participants refer to backup of human resources to illustrate redundancy. Findings indicate that organisations of FRM, especially at the AMA, do not have adequate personnel to deal with flood risk and impacts. Representative of Public Health Directorate of AMA argues in the interviews that, insufficient staff compels the directorate to employ student interns as source of additional workforce:

> We have a programme that tries to beef up our staff so we train graduates to add to our number of staff. Manpower, you see, our staff is woefully inadequate. The World Health Organisation (WHO) standard requires that for every population of 700, we need an environmental health officer. This means that we need a lot of health officers in the Accra Metropolitan Assembly (Representative of LPD, July 2013).

The quotation suggests that the number of environmental health officers of the public health directorate of AMA is below international requirements. Unexpected course of flood disasters has environmental health component as flood events come with risk of cholera and other water borne disease. Environmental health education forms part of FRM and require adequate staff to deal with the issues.

Findings further disclose that NADMO depends on DVGs as additional support for FRM. To illustrate this point, representative of NADMO explains in the interviews that:

> A lot has been learned with regards to empowering volunteers. Most of the disaster management in the city of Accra; most often depends on the volunteers. Because by the time NADMO team gets to the disaster scene, the volunteers are already there to do the fighting. We have learned that we need to empower our disaster volunteers groups. We have to form volunteer groups all the communities that we have in our sub-metros. Also in the schools too we have disaster clubs so that they will be able to educate the communities how to deal with disaster risk. They will have to tell people what to do when there is a disaster. The DVGs as the front liners are very helpful (LND respondent, August 2013).

The quotation seems to indicate that volunteers are crucial for immediate response to flood disasters. Similarly, DVGs can be useful backup for responding to unexpected course of flood disasters.

NGOs also make use of volunteers. Research participant from St. John's Ambulance argues in the interviews that:

> We operate on a system of volunteers or volunteerism. We use volunteers from all over the country. We have about 22 staff strength here at the headquarters. The volunteers do most of the work. The remaining workers are volunteers numbering about 4,250 and there representatives of St Johns in every region and district in the country. These volunteers are trained by us but they are not our staff (representative of NJA respondent August 2013).

Redundancy is further explained with reference to finance and logistics resources for response to the course of unexpected flood disasters. The empirical findings indicate that funds and logistics required for expected flood risk and impacts are inadequate for organisations of FRM. There seems to be no opportunity for individual organisations from national, regional and district levels to have savings and reserves as backup for dealing with unexpected course of flood disasters.

It can also be observed in the results that coordination of additional resources among organisations further indicates redundancy of response resources for dealing with unexpected course of flood disasters.

Empirical findings further specify that additional resources come from external sources for responding to courses of flood disasters. Research participants explain that main funding comes from government with additional support from private organisations. Research participant from national organisation in FRM explains in the interviews that:

> Funding mainly comes from state coffers but we also mobilise from all other institutions - private sector as well. We use Air Force and Navy colleagues for surveillance, search and rescue of flood victims (Respondent of SAF August 2013).

The quotation claims that human and material resources are outsourced from partner organisations. Another interviewee argues alike that:

> We are for government and our services are free. We do not generate funds or additional resources to fund our activities we rely on the government for finance to be able to carry out our activities, we don't charge for our services. Yes we cannot source funding directly from outside. But our parent Ministry of Water Resources, Works and Housing when it becomes necessary, they look for funding outside to support our efforts if government cannot provide funding adequately, so they look for external support for us (SHS Respondent, August 2013).

Again, it was further explained that government is the main provider of resources for its agencies in FRM whereas additional response resource come in forms of donations from international organisations:

> It is a social responsibility of the government to ensure that the institutions mandated to provide the services of flood disaster management are resourced enough in terms of equipment and capacity to deploy/provide such services. The World Bank assisted four stakeholder institutions, the GMA, NADMO, Hydro Services and Water Resource Commission to install and run flood forecasting model called the FEWS Volta (flood and early warning system Volta) (GMA respondent August 2013).

Once more, research participant from NADMO of the AMA argues in the interviews that finances for FRM come from government subventions and internally generated funds which are insufficient and sometimes arrive late for projects:

> Allocation of the internally generated fund, that is money received from grants, donations and gifts are useful. Additional resources for NADMO of Accra Metropolitan Assembly for flood management activities come from private organisations but the question is how often does this support come? I have written to the private organisations for financial and logistics support but I have not received response yet (Representative of LND, August 2013).

The quotation further shows that government subventions do not come in time and on regular basis. Consequently, implementation of FRM plans is delayed or unfinished.

Interviews also indicate that some NGOs involved in FRM face financial challenges and cannot have savings and reserves in wait for flood disasters. They rely on external support to respond to unexpected flood disasters. Research participant representing an NGO in FRM explains in the interviews that:

> We have the human resources, trained personnel are available to team up for response but the financial resources we have a problem. Occasionally, NADMO brings in some items for response as part the preparedness. Occasionally, these items are brought to us; most which we already have. You see, they bring us what they have. Also other international brothers use to give us help but now with our country, Ghana, becoming a lower middle income status, there are things that use to come but have ceased. They have to be sent to other countries that are in need (NJA respondent, August 2013).

Coordination of additional resources from partner organisations in FRM seems to support capacity in response to the course of flood disasters.

Moreover, research findings show that the UN Systems seem not to have resources constraints. During the interviews, a research participant explains how resources are mobilised by the organisation in support for FRM in the city of Accra:

> We mostly sustain this by sharing a lot of information with the other agencies. You see them contacting us every day and we can boast of that. When it comes to human resource, we have all the experts at our disposal. We have the WHO that gives us the doctors and there is also the IOM who will move you across borders, the UNCHR are there to protect refugees and others. It is not a big problem when it comes to human resource. We have UNICEF catering for water and sanitation and handling other key areas. It is not only Ghanaians but also internationals. We also have the research capacities and we have the research agency that is willing to help and conduct any

> research. In terms of finance, we have put in place mechanisms to take good care of that. When we are running out of food and water and other vital items, we just have to write a proposal to CERF for funding and we took about 1.2 - 3 million dollars from them. When cholera broke out we wrote to CERF and they gave us the money for that. So for funds we have no problem because we can rely on the opportunities created by the UN. We use the capacities of our colleagues to actually implement things on the ground. For example if we want to distribute food we can use NADMO or the Red Cross and Crescent. We have a lot of resources and they are mostly immense. One of them has to do with our credibility alone. Our credibility is a major factor and if we want to hold an emergency meeting, we get the number that we want (IDP respondent, August 2013).

The quotation illustrates that coordination and information sharing seem to be useful for mobilising response resources. Craft Emergency Relief Fund (CERF) is also fundamentally established for dealing with crisis situations. Red Cross and Crescent organisation also has emergency relief funds set aside for responding to flood disasters.

In brief, the results indicate that redundancy in response resources illustrates characteristics of resilience but organisations of FRM strategies have neither savings nor reserves, except the UN systems. Results reveal that organisations of AMA, NADMO and St. Johns Ambulance have no adequate and had to resort to volunteers in response to unexpected course of flood disasters. Organisations seem not to have savings and financial reserves for unexpected flood disasters. Coordination of additional resources for response to flood disasters refers to redundancy regarding resilience in FRM strategies. However, the new NADMO bill in-progress includes establishment of disaster management funds, exclusively for responding to disasters.

Indicator *Design of measures and instruments beyond determined probabilities of flood risks*

Research participants further explain redundancy in reference to design of response measures beyond expected probabilities of flood risk.

It was learned from empirical findings that humanitarian assistance to flood victims comes from various sources. Research participants representing international development organisation explained that:

> If flood impact in area exceeds available stockpile there, then the Area Development Plan manager has to make another request to the national office that it has run short of relief items. We are not providing the relief support alone; you know the district assembly itself will take part of it, so ours (the NGO relief support) is a supplementary kind of effort, very supplementary. Whatever we would need, we have registered vendors, so we contact the supply chain and tell them that we need these things immediately and they also contact their vendors and the supply is made. There are some that we have already like tents and mattress, those that are not perishable, yes we have a stockpile somewhere. If it is volunteers that we need to get, yes, we work very complementarily with other organisation but not competitively. So when another organisation is bringing something to support disaster victims, we don't see it as conflicting (representative of WVI, August 2013).

The quotation indicates there is shortage in stockpiles of relief items for victims of flood disasters. Registration of the vendors and suppliers of perishable items and coordination of relief items from sister organisations additional source of resources. Yet again, research findings further indicate that re-insurance is a strategy applied by insurers in response to unexpected damage or loss of property from flood risk beyond determined expectations. However, it was made clear in the interviews that flood insurance is not common and only few individuals and companies insure properties against floods. An interviewee from national organisations in FRM argues in the interviews that:

> When the risk is too huge we invite the second insurance companies for reinsurance. For every insurance holder, we have to reinsure so that when it comes to compensation your reinsurance will help you to deal with the claim. So our reinsurance helps us with the flood risks. We do investments and if your investment is not matured we try to see which areas to get money so that while waiting for the investment to come we deal with the claim but we set emergency funds. We are able to release funds; the Treasury Department is able to release funds quickly sometimes monthly to meet the claims payment (Respondent of PSI August 2013).

Besides re-insurance, investments, emergency funds and treasury department of the company in question bear characteristics that focused on dealing with consequences of floods beyond determined risk and impacts. The results indicate that outsourcing

resources from vendors of stockpiles and re-insurance can be strategies for dealing with unexpected flood disasters beyond determined flood risk. Findings suggest that flood insurance is not a main characteristic of FRM strategies of the study site.

5.1.6 Resilience aspect *Buffer capacity of the flood risk management strategy*

Research participants refer to buffer capacity in description of resilience in FRM strategies. Details of quotations referring to indicators and identifiers of buffer capacity are presented in next sections.

Indicator *Additional performance of risk reduction measures of organisations*

Research participants in the interviews make reference to additional performance of the designed and implemented risk reduction measures beyond known (determined) flood risks as indicator of resilience. Research participants suggest that more performance of engineered measures beyond expected flood risks could create room for unexpected course of flood disasters. Empirical findings indicate that common most recurrent flooding in the city of Accra is 10-year return floods. However, interviews further indicate that 75 years or 100 years return floods do occur. Research participant from hydrological services department in the interviews illustrate that channels and drains in the city of Accra are designed beyond expected return floods:

> Normally what we have observed is that we tend to experience ten-year return floods in Accra, sometimes it is not that the precipitation is so much. But we do not design for ten years as I said we design for 25 years that is for some of the primary drains but for the major culverts we design for 50 years even if the drain is 25 years once the culverts crosses the drain is a major one we design for 50 years. But as I said the peak is very much high within the city due to the absence of retention and detention depressions we used to have (Representative of SHS, August 2013).

Another hydro-engineer supports the above point but further observes in the interviews that extreme floods beyond 25-year return floods can overwhelm the existing drains in the study site:

> In our design, we use let's say frequency of 1 in 25 years return flood for the design of our storm drains. But it can happen that, 1 in 100 years, 1 in 70 years, 1 in 50 years flood comes. It means that those drains cannot accommodate the flow, if they cannot

> accommodate it the water would spread over banks (Representative of WERU, August 2013).

This assertion further explains that designers of drains are aware of extreme flood events that require channels and drains with capacity for 1 in 100 years flood. However, this is lacking at the moment and implies any flood event beyond 1 in 25 years flood can be disastrous.

Moreover, land-use planning documents and research participants further argue in the interviews that buffer capacity can refer to buffer created zones along channels or watercourses. Land-use plans of the Department of Town and Country Planning indicate buffer zones for dealing with flood risk:

> All land below 1 in 15 year flood line should be included in special flood prone zone and further development prohibited within this area (Ministry of Local Government Department of Town and Country Planning, 1991: 99).

Furthermore, civil engineer from department of urban roads of the AMA explains in the interviews that:

> In our design of storm drains, we create buffer zones. We let the district assemblies know what the buffer zones along all our drains are so that no building is expected to encroach on these buffer zones. The buffer zones are supposed to contain the excess flows but people don't abide by it. People build very close to the drains and the drains don't have any buffer zones and so the flood has nothing to do rather than to go into the people's rooms (TCD, August, 2013).

The quotation illustrates that land-use plans and regulation create buffer zone along channels but have been encroached by developers. People build in these zones illegally.

In summary, empirical findings refer to buffer capacity in FRM strategies in response to the unexpected course of flood disasters. This is shown in the designed and implemented measures beyond determined flood risk with capacity to respond to 25 years return floods instead of 10 years return floods that occur regularly in Accra. Empirical findings also show that land-use plans and regulation create buffer zone for flood waters along channels but they have been encroached by developers due to lack of strict regulation enforcement.

5.2 Aspects of Anticipation

This section presents results on aspects of anticipation in FRM strategies. Quotations from interviews with the research participants indicating anticipation in FRM strategies are presented in the next sections. The quotations refer to resistance to known risk, maintenance of boundary conditions of risk management strategies and specialisation for dealing with specific flood risk in FRM strategies.

5.2.1 Anticipation aspect *Resistance to (known) flood risks*

Research participants refer to indicators of resistance to known flood risk in the FRM strategies in the interviews. First, there is a definition of specific roles for organisations in FRM in the interviews. Definition of roles can facilitate resistance to flood risk since responsibility of each organisation in FRM becomes unambiguous. Second, interviews show that assessment of flood risks within and among organisations indicates resistance. Risk assessment is a requirement for decision making in FRM. Third, resistance to known flood risks refers to consideration of long-term change within and among organisations as an indicator. This indicator focuses on addressing flood risk from climate and societal changes. Moreover, structural and non-structural FRM measures are means to resist flood risk and have also been indicated in the interviews. Indicators of resistance show means to preventing, mitigating or reducing flood risk. Findings on the indicators are presented in the following sections.

Indicator *Specific role and responsibility of organisations*

Empirical findings indicate that organisations in FRM play specific roles as demonstrated by results on stakeholder analysis in chapter 4. The roles are specified NADMO Act 517 and disaster risk management policy documents. The roles are also legislative mandates of organisations. National disaster management policy documents that include FRM are disaster management plan 2010, the national disaster standard operations procedures 2010, the national building guide for lightly loaded structures in disaster prone areas 2011 and disaster management volunteer group guide 2010 and AMA disaster management plan 2010. The Accra metropolitan disaster management plan 2010 spells out how the authorities in city of Accra deal with flood risk and impacts as part of overall disaster risk reduction

approach. The plan outlines flood prone areas, element at risk to flooding, safe havens as well as organisations responsible for specific FRM.

Research participants further confirm in the interviews that roles of organisations in FRM are mandated by law:

> In fact, we have a mandate in FRM as part of emergence disaster risk management. This organisation is established by law in Ghana and our mandate to prevent loss of lives by providing first aid to victims of all disasters. It is this mandate that makes us aware of roles (Representative of NJA, August 2013).

Again, research participant from NADMO explains in the interviews that:

> We coordinate and serve as implementation agency for disaster risk reduction. ... If the permit for a building does not go through an administrative channel, for instance the planning committee of Accra, then we have the right to demolish the houses. No major development can be done without permit from the Accra Metropolitan Assembly (AMA). There is a land use plan for the whole of Accra. Before a structure is put on any land in Accra, a building permit must be given by Accra Metropolitan Assembly. So Accra Metropolitan Assembly has a control over every developer in the city of Accra (Respondent of LND August, 2013).

The quote indicates that city authorities have legislative powers to FRM in Accra. It can be summarised from the quotations that organisations in FRM play specific roles in resistance to determined flood risk. However, resistance seems to be challenged by poor enforcement of FRM regulations.

Indicator *Assessment of flood risks within and among organisations*

Findings show that FRM in the city of Accra includes risk assessment. Empirical findings from stakeholder analysis in chapter 3 confirm that FRM includes risk assessment. Assessment of flood risk is captured in the disaster management plan 2010 of the Accra Metropolitan Assembly (AMA) as well as in the interviews. During the interviews, the research participants mention risk assessment in reference to identification, analysis and mapping of flood risk. Research participant representing organisation in FRM from national level explains in in the interviews that

> Accra is mapped out into zones with different flood risk levels (Representative of SAF, August 2013).

Similarly, another interviewee from NADMO of AMA explains further that:

> We have a disaster management plan for the AMA which includes flooding. The plan is such that every sub-metro needs to identify disaster risks within these areas. We called it hazard mapping in these our sub-metros. We have been able to identify all the flood prone areas which are within our area of jurisdiction. It is not all of the sub-metros that are flood prone but we have spots in the sub-metros which are flood prone. The major areas are the Okai Koi South which is around the Darkoman area, Ablekuman North around Sakama Area, Odawna, Adabraka Official-Town within the Osu Klortey Sub-metro. Those are areas prone to floods (Respondent of LND; August 2013).

Another research participant representing organisation in FRM from national level states that:

> We have prepared well more or less, FRM plans for some parts of Accra. This you can also get copies from NADMO. Accra Metropolitan Assembly, I know they also have a plan. In fact I drew up the programme for Accra Metropolitan Assembly this year, the flood mitigation, areas that they need to work on. I drew it up for them this year, so they have (Representative of SHS2, August 2013).

However, it also emerges in the interviews that flood risk assessment takes places and results in reports and FRM plans but actions to reduce floods are not effective:

> One major problem we have identified is that we are a coordinating agency so we find it difficult to take action on any sort of disaster risk we have identified and agreed on. We can identify a building in the flood prone area which needs to be demolished but we don't have the means of doing that. We have channelled everything through the district assemblies to get those houses demolished but this takes a long time. This is our problem. Our national coordinator has been working round the clock to see how best our agency could be made a service so that we could be empowered to do our work well. By so doing if we identified a building on a waterway, we would be given equipment to demolish structures without any problem (Respondent of LND, 2013).

The quote indicates that FRM is a shared responsibility among various stakeholders in the city of Accra and it can delay response to determined flood risk. Determined flood risks that require immediate response can delay due to process or lack of resources to instant response. Removal of buildings in waterways involves several organisations, which considerably takes a long time to mobilise. Moreover,

demolition procedures require court orders, which sometimes delay due to litigations with landlords.

In summary, empirical results indicate that assessment of flood risk within and among organisations forms part of FRM strategies to resist determined flood risk. However, implementation of FRM plans and regulations to resist determined flood risk are faced with challenges from poor enforcement of regulations and inadequate resources.

Indicator *Consideration of long-term change of flood risk within and among organisations*

Long-term changes of flood risk have the tendency to influence the anticipated response capacity of key stakeholders of FRM. This can particularly be true when the changes in flood hazards and vulnerabilities are highly unpredictable in quantitative terms. However, consideration of long-term changes on the basis of scenarios may help to prepare for changes in boundary conditions of flood risk in the future.

The empirical findings further show that anticipation in FRM strategies refer to indicator for consideration of long-term change in flood risk. The indicator refers to identifiers regarding scenarios of climate and societal changes that affect flood risk. In particular, research participants in the interviews explain that FRM plan of Accra follows international disaster risk reduction practices of the United Nations and refer specially to policies of the International Strategy for Disaster Risk Reduction. It was argued in the interviews that FRM plan of AMA follows the Hyogo Framework for Action 2005-2015 which considers climate and societal changes affecting flood risk:

> In terms of policy direction, yes, we go by the Hyogo Framework for Action 2000-2015. Our organisation (UNDP) has supported the national disaster management organisation (NADMO) to develop an action framework (plan) for disaster risk reduction. Since we deal with a national agency (NADMO), which is in charge of influencing framework of action through the Hyogo framework. To inform policy direction and decisions, we contribute to come up with a framework (Respondent of IDP, August 2013).

NADMO subscribes to Hyogo Framework for Action 2005-2015 and programmes for making cities resilience to disaster risks. Long-term programmes also include capacity building, training and collaboration with organisations of FRM.

Interviews further indicate anticipation aspects of FRM strategies by referring structural and non-structural measures for prevention and mitigating flood risk. Research participant from AMA mentions public sensitisation, desilting, clean-up in rainy season as well as construction and maintenance of channels in reference to anticipation in FRM strategies:

> In fact, the last time I told you we have programmes. I mean before, ideally they have been a lot of education and sensitisation but still in this part of the world it's still a problem. There are issues with accessibility to some of the flood prone areas. And if you go to these poor communities anytime it rains what they do is they just take their rubbish and they just dump them into the rains they think the rains will wash it away. So what we do is that before the rainy season we embark on what we call the desilting of these major channels, and not most of them are line, we have only few like the Odaw, the Chemu channels which were just recently done but because they are not lined. There is also gravel in channel and this is a problem of siltation in itself (Representative of LRD, August 2013).

The quotation shows that the programmes take place prior to rainfall season when flood is expected.

Interviews further indicate that structural and non-structural FRM measures are applied in response to determined flood risks:

> Well the non-structural measures we use public education. We go out, educate the public on the effects of floods, how they should comport themselves when they see floods, when they see the rain what they should do, and where they should run to. If the flood comes to their homes what they should do - they should immediately put out their lights. If unfortunately they haven't put off their lights and there is water in their room they should run to the top of their tables so that if there is electricity failure or contact they wouldn't be electrocuted. We do all that, those are the non-structural measures and even we do advertisement to tell the people that we are coming into the rainy season so this is what we will be doing. But the structural measures are the drainage structures for the conveyance of flow from flood prone areas. Some of the drains are concrete lined, some of them only ordinary channels deepening and widening to create access for flood conveyance. We also go into emergency flood

> relief works in the form of going to clean all channels before the rain falls (WERU Respondent August 2013).

The quotation is similar to the Conti Project which has been mentioned as a major drainage work in Accra. Further, eviction and relocation of settlements in waterways indicate resistance to determined flood risk in Accra. It was explained in the interviews that:

> The AMA had to pull down about 1500 houses in 2009 to create conducive atmosphere that we are experiencing now. Initially people thought the AMA was up to something mischievous. NADMO has become proactive so we have building codes. We have building code book to guide people who want to put up buildings. You see what I have noticed is that buildings in flood prone areas are not high rise buildings (Respondent of LID, August 2013).

Again, the research participants confirm in the interviews that local NGOs and community development organisations resist eviction and relocation programmes. In this regard, representative of the Slum Union of Ghana and Old Fadama Development Association explains that the city of Accra as below:

> The community has been marked for eviction. The authorities look down on this community and we need to prove to them that we are not ignorant and they need to hear from us. Several eviction attempts have been made since 2003 and the worst of it all was in 2009 and because of that, individuals in the community came together to form the Old Fadama Development Association to serve as the mouth piece for the people and that is why I am the spokesperson here. My involvements have been to hold press conferences to tell the media and Ghanaians that the community is not the home for criminals and other deviants. Also because of the activities with Amnesty International and Slum Union International I have the opportunity to travel and present our case. We get support from these organisations and because of that a lot of researchers come here to seek for information (representative of SUG/OFDA September 2014).

NGOs and flood-prone community organisations argue that eviction violates human rights of people who are evicted.

Similar to findings from the stakeholder analysis in chapter 4, that poor involvement of land owners and flood-prone communities in decision making and implementation FRM strategies also explains why people disregard regulations for responding to

determined flood risk. Representative of Ga Traditional Authorities explains in the interviews that:

> The FRM plans and regulations have not worked for the AMA because the city authorities try to handle issues on their own. They think they can do everything without even involving owners of the land. …They take decisions at the top and implement them right away which they find some complications. There is a big gap between the chiefs and the city authorities (Traditional Authority Representative, September 2014).

Humanitarian organisations provide food and medical aid for victims of flood disasters. The relief and reconstruction department of NADMO and other humanitarian and rescue organisations are solely set up to serve this purpose. The Accra Metropolitan Disaster Management Plan of 2010 by NADMO outlines plans for these interventions prior to flood event. Safe havens are identified to provide temporary shelter for victims of flood disasters. Safe havens include chief palaces, stadia, tent and canopies on hilltops, churches and logistics for evacuation when necessary.

It can be learned from the quotations that, anticipation in FRM strategies referring to indicators and identifiers of resistance to known flood risk. Anticipation indicates structural and non-structural FRM measures. The findings from stakeholder analysis, specifying key stakeholders of FRM and their respective roles further explains anticipation in FRM strategies. However, findings also suggest that implementation of the FRM measures faces challenges with inadequate resources and resistance from developers in waterways.

5.2.2 Anticipation aspect *Maintenance of boundary conditions of flood risk management strategy*

Maintenance refers to anticipation and indicates activities that enable structural and non-structural measures of FRM to function as designed. Maintenance of boundary conditions includes desilting of drains, clean-up of urban waste and patching up of worn-up measures. Updates of FRM measures can strengthen their capacity to respond to determined flood risk. Training and retraining of personnel of FRM organisations further indicates that maintenance fortifies response to determined flood risk. Research participants in the interviews refer to means of reinforcement of

implemented measures within and among organisations. Details of quotations from the interviews are presented in the next section.

Indicator *Means of reinforcement of implemented* flood risk management *measures within and among organisations*

The research participants explain in interviews that reinforcement of implemented FRM measures is critical for sustaining their functions and ability to cope with flood risk. To begin with, it is crucial to mention that results from stakeholder analysis in Chapter 4 reveals importance of maintenance in the capacity of Drains and Maintenance and Waste Management Departments of the AMA. Reinforcement was expressed in the interviews with reference to desilting and patching of drains, clean-up of wastes and removal of structures in waterways. Research participant illustrate this point in several ways. Research participant representing organisation of FRM from national level explains in the interviews that:

> ...the city authorities have been dealing with such situations for maintaining the drains and then maybe making sure that these drains they are free enough for water to flow without any impediment but don't have enough capacity to monitor all from the primary to tertiary drains. The primary drains are free from unwanted structures but challenge with them is silt and waste accumulation. Financial challenges and human activities turn to negate our efforts. People still build within the flood-prone areas and dump refuse into drains. These are the challenges but what affects our projects is funding. We don't get the full complement of what we need to be able to take the activities of each year. The resources given us are not enough (Representative of SHS August 2013).

Again, research participant from NADMO of the AMA explains in more detail that:

> Human nature as it is, we still have the good and the bad ones but we still do our best to avoid these negative attitudes of people. As much as possible, we try our best to prevent people from putting buildings on waterways. There are recalcitrant ones who still try to do it but I can tell you that once we see that, we would demolish. One thing I like about our mayor is that once it rains in Accra, he goes out with the task force to inspect such structures on waterways and demolish them. As for desilting, it is done by the various sub-metros. There are special teams of sanitation workers that do clean-up and desilting. But at times one major we noticed is that some of the drains are too big for the workers to desilt, they need big machines to do so. Desilting is done occasionally but this is not the best. We advise that human attitude has to change for the better. Immediately it starts raining, you see human beings throwing

> refuse into the drains thinking that the water would carry the garbage away but this end up choking the drains to cause flooding (LND representative, August 2013).

The quotations illustrate that despite the efforts to ensure that drains are free of silt and unwanted developments, developers build structures in waterways and people deposit debris in drains. Funding is also a constraint for maintenance of FRM measures.

Research participants further confirm in the interviews that organisation of FRM engage in clean-up activities in Accra to ensure that drains are free of waste. Interviewee organisation of FRM in the AMA explains that:

> Sometimes, before the rain, stakeholders of FRM organise at the community level to do general cleaning exercise. They even go to Abossey Okai area in Accra to make sure to make sure that on Saturday between 6:00 a.m. and 12:00 noon all stores are closed and they encourage people to clean their environment (LRD representative, August 2013).

Empirical findings show that capacity building workshops and training programmes are organised for staff of organisation in FRM. Workshops and training programmes organised by NADMO and international organisations. German International Development Cooperation (GIZ) and Federal Emergency Management Agency (FEMA) as well as of North Dakota Emergency Management Service (NDMS) of the United States of America are part of the capacity building programmes. For instance NDMS of FEMA had a five-day incident management system training from March 3-7, 2014 in Accra. The training is a follow-up of the first phase, which took place in March 2013 (NADMO, 2014**).**

It was further explained in the interviews that members of DVGs go through training on response to flood risk but lack of funding is a drawback:

> We are also trying to empower the communities by forming disaster volunteer groups (DVGs) in the various communities. We have played our part by trying to put the groups together but we have not been able to sustain them financially. We need to pay them but finances are unavailable. We empower the DVGs through training programmes. We train and teach them what to do when there is flood, after flood and before flood. These also include to identifying flood flashpoints and waste management strategies (LND representative, 2013).

It can be learned from the findings that maintenance of boundary conditions of FRM strategy refers to efforts to reinforce functions of implemented measures and human personnel of FRM. The findings indicate that inadequate funding, encroachment on waterways and dumping of waste in drains make maintenance of boundary conditions of FRM strategies counter-productive.

5.2.3 Anticipation aspect *Specialisation in dealing with specific courses of flood disasters*

In the interviews, research participants mention specialisation in dealing with specific courses of disasters in reference to anticipation. Flood risk may affect specific sectors of the society, which will require sector-based responses.

Indicator *Sector-based approach to FRM*

Empirical findings show that organisations in FRM strategies have particular expertise. Findings from stakeholder analysis show that organisations in FRM have specific roles. Some organisations specialise in responding to health risk of floods while others only concern with search, rescue and evacuation. On some cases, some organisations specialise in clean-up after floods. It was learned from the findings that organisations of FRM belong to special technical committees on merit of expertise in response specific flood risks. The following quotation from the interview illustrates that organisations in FRM have specific expertise:

> My organisation as I said is mandated to look at flood disaster control measures, so when I go to this committee, I become the main person, focal point on flood management in that committee because people who are coming from other agencies do not have the requisite expertise and knowledge that I have so I put my knowledge across to these people, sell the knowledge to them, they buy it and then we all go out to sell the idea. The person from Meteorological Agency brings his idea, it is put across, people accept it and then we go out to sell (Representative of SHS2, August 2013).

The quotation seems to suggest that the organisations of FRM may have expertise in climate and hydrological aspects of flood risk. Others may be related to natural and built environment components flood risk. There are also social and economic components of flood risks that require attention.

Empirical findings from FRM plans of the AMA and the interviews show that flood insurance is not a major component of FRM strategy in the city of Accra. Flood insurance is concerned with economic cost of floods. Flood insurance can therefore be associated with organisations from economic sectors. Interview with research participant from insurance company, which was formerly state-own, explains that:

> No, SIC Insurance Ltd is not part of any FRM body in Accra that I know of. It is only when our insured is involved in flooding that we try to come in to compensate the person but we are not part of the planning of the city and therefore we have no control over it (Representative PSI, August 2013).

Flood insurance seems not to be considered in FRM. However, government bears the cost of relocating communities away from flood-prone communities and victims of flood disasters. Although sector-based, response to determined flood risk demonstrates anticipation. Flood insurance, which applies the principle of sharing economic impacts of floods, is not considered in the FRM strategies.

In summary, the impirical findings on resilience and anticipation in FRM strategies in this chapter. Based on those findings, the next chapter focuses on hypotheses for advancement of resilience in FRM strategies.

6 Hypotheses for advancing resilience and anticipation in flood risk management strategies

The hypotheses development begins with a conceptual proposition of each aspect of resilience and anticipation in FRM strategies. The propositions refer to the operationalisation of resilience and anticipation in FRM strategies. The operationalisation is demonstrated by relevant indicators and corresponding empirical findings. The empirical findings serve as basis for derivation of the hypotheses for advancement of resilience and anticipation in FRM strategies.

This research does not test the hypotheses. Rather, the derived hypotheses aim to inspire follow-up research for advancement of the conceptual framework. However, the researcher suggests specific approaches for testing the hypotheses. The approaches serve as catalyst for future research on the framework of resilience in FRM strategies.

6.1 Hypotheses on advancing resilience in flood risk management strategies

Hypotheses for advancement of resilience in FRM strategies are presented in this chapter. To facilitate derivation of the hypotheses, reference is made to relevant findings on resilience in FRM strategies from chapter 5.

6.1.1 Hypotheses for resilience regarding *Omnivorousness of the flood risk management strategy*

Omnivorousness of FRM strategy is inspired from the view that organisations can benefit more from the use of diverse kinds of resources and channels for distributing response resources for dealing with unexpected course of disasters than depending on a single source of response resources and one channel for distribution of the resources (Wildavsky, 1991; Hollnagel *et al*., 2006; Wardekker *et al*., 2010). This proposition describes resilience in FRM strategies in terms of diverse means of responses and sources of response resources to cope with unexpected course of flood disasters. The diversity in response conceived as capacity to respond to hazards, vulnerability and exposure and consequently deal with flood risk. Diversity is strength for managing unexpected course of flood disasters in that, a supply failure

of one source of response resources and others of their kind can compensate for channel of response. Unexpected course of flood disasters can be issues of uncertainties and undetermined risk. On this basis, one could see a positive correlation between an increase in the degree of omnivorousness of the risk management strategy and resilience of organisations in managing unexpected course of disasters and impacts in general.

In this research, omnivorousness is described by indicators of diversity of sources of responses resources and diversity of responses within and among organisations. An increase in the diversity of these indicators has consequential increase in omnivorousness which could lead to potential increase in organisations' capacity to determined disaster risk and impacts. The diversity of responses is further expressed by variety of organisations and sources of knowledge, consisting of expert and local knowledge for dealing risk. Moreover, considerations of strategies for managing risk before, during and after disasters are crucial.

Empirical findings from section 5.1 show diversity in sources of responses and response resources in reference to resilience in FRM strategies. Diverse sources of responses resources and responses flood risk come from various international, national, regional, metropolitan, NGOs, traditional authorities, private business organisations. Policy makers and technocrats are involved in FRM for different perspectives. Response to unexpected flood risk relies makes use of resources from different organisations which can strengthen their response capacity to deal with unexpected course of flood disasters.

However, empirical findings reveal weaknesses in diversity regarding resilience in FRM strategies. The findings indicate that a few key organisations in FRM strategies are not directly involved disaster management committee of AMA that takes decisions on FRM plans and implementation. Results show that local chiefs, Slum Union of Ghana, Old Fadama Development Association, and key private sector organisations do not have representation in the committee. Lack of representation of these organisations in the committee seems to be a weakness in diversity of sources of response and responses regarding resilience in FRM strategies. Lack of involvement of the organisations does not allow them to directly contribute to decisions on FRM strategies. Empirical findings also show that lack of involving

flood-prone communities (Old Fadama Development Association) leads to resistant against implementation of eviction and relocation of developments in waterways. Results further show continuous deposit of wastes in drains and encroachment on waterways in the city. One can argue that involvement of the local organisations can make responsible for dealing with the problem of waste and encroachment on waterways. Based upon the empirical findings, the following hypothesis for advancing diversity regarding resilience in FRM strategies is derived.

Hypothesis: Involvement of the local chiefs, Slum Union of Ghana, Local Development Associations of flood-prone communities and key private sector organisations in FRM strategies in the city of Accra would amend their response capacities in diversity of sources of response resources and allow for advanced resilience regarding their responses to the impacts of land-use changes and the waste disposal in watercourses.

The hypothesis can be tested by conducting research that applies mixed methods approach to verify the contributions of the local chiefs, Slum Union of Ghana, Local Development Associations and private organisations towards the diversity of sources of response resources and responses to unexpected course of flood disasters due to changes in climate and land-use.

6.1.2 Hypothesis for resilience regarding *Homoeostasis of flood risk management strategy*

Homoeostasis regards awareness of organisations of FRM strategies about unexpected course of flood disasters. It is concerned with awareness and knowledge about the organisations of FRM strategies about unexpected course of flood disasters (Wildavsky, 1991; McManus *et al*., 2007). Awareness regarding resilience in FRM strategies can contribute to alertness of organisations food risk and subsequent response.

The empirical findings from Chapter 5 of this research refer to awareness regarding resilience in FRM strategies. Awareness can be indicated by processes and platforms for sharing information and knowledge for response to unexpected course of flood disasters. The empirical findings indicate that platforms for awareness of FRM include meetings, committees, operations centers and various media of

communication and sharing of knowledge among organisations of FRM strategies. Results show that organisations are aware that flood events can occur at unexpected times with extreme impacts. Reference was made to the floods that occurred in the late hours of 25th October 2011 to the early hours on the 26th October 2011 in Accra. The floods were argued to have been caused by five-hour duration of rainfall with different depths recorded in the various rain gauge stations in the basins. Its impact was described as unexpected with hundreds of people rendered homeless, twelve people dead and property worth millions of cedi destroyed.

The empirical findings also indicate that resilience in FRM strategies refers to awareness of organisations to unexpected course of disasters in real flood events. The findings refer to collapse of physical structures, choking of drains and sudden inundation of areas unknown to flood risk. There is also indication that rainstorms can result in in the collapse of trees, buildings, utility lines, electricity wires and poles that negatively affect human life and property. It was argued that deaths associated with previous flood disasters could be linked to electrocution, so the electricity company has been part of the emergency management. The most recent flood disaster of 3rd June 2015 caused an estimated loss of 150 to 200 lives due to a gas explosion around Adabraka area in the city of Accra this event further explains such unexpected incidents that are hard to determined (Okai-Koi South Sub-Metro Report, June 2015).

The research participants further explained the unexpected occurrence of flood risk using various expressions describing its stochastic and irregular happenstance. For example, the research participants predominatly claimed that “a disaster has no timetable” (GRI representative, August 2013) while others similarly explained that “a disaster is not a routine process only, a firefighting strategy is sometimes necessary for flood disaster management” (LND representative, August 2013). Moreover, the representative of hydrological services department argues that there are possibilities for a worse future flood risk in the city as all wetlands are encroached and the discharge increases in volume to cause inundation. The arguments above suggest that research participants have knowledge about the unexpected course of flood risk.

The Accra Metropolitan Assembly has eleven sub-metros with NADMO offices that identify and report flood risk for action. DVGs serve local response to flood risk. The DVGs and disaster prevention clubs in schools sensitise communities on flood risk awareness. Clean-up of silted and choked drains and monitoring of the identified flood-prone areas of Accra further “enhance instant response to emergencies” (Okai-Koi South Sub-Metro 2012: 1-3).

The empirical findings further show weakness of organisations that can be a drawback on awareness regarding resilience in FRM strategies. The findings indicate that organisations whose activities in FRM can facilitate awareness of unexpected course of flood disaster are constrained by lack of resources to perform duties effectively. From the results in section 5.2, NADMO has no finance to sustain DVGs for monitoring and response to flood risk in communities. The hydrological services department has no flood recorders to monitor volumes of floods. Ghana Meteorological Agency which is responsible for forecasting and early warning of floods has no resources to procure current logistics for advanced lead forecast. Technology for seven days lead forecast of flood event is useful but it does not exist. Lack of resources of the organisations is a setback on resilience in FRM strategies regarding awareness of unexpected course of flood disasters since the capacity to identify perform is not available.

The empirical findings on homoeostasis have led to the following hypothesis for advanced resilience in FRM strategies regarding increase in the capacity of organisations for awareness of unexpected course of flood disasters.

Hypothesis: Provision of adequate finance for Hydrological Services Department to secure flood recorders, Ghana Meteorological Agency to procure 7 days lead weather forecasting model for early warning of floods, and NADMO to sustain DVGs would increase their response capacity in awareness of unexpected course of flood disasters to increase the current response capacity of organisations in FRM strategies.

The hypothesis can be tested by conducting research that applies mixed methods approach involving surveys and in-depth interviews. This would allow to test the correlations between provisions of adequate finance to secure requisite technology

for the organisations and improvement in their response capacity in awareness of unexpected course of flood disasters and advancement of resilience in FRM strategies.

6.1.3 Hypothesis for resilience regarding agile and timely flow of response rate of the *flood risk management* strategy

Agile and timely flow of response rate of FRM strategies describe conditions for quick distribution of response resources to deal with unexpected course of flood risk. Conditions refer to features for agility and timely flow of responses. Agility is a crucial component of the operational continuity of organisations in response to disaster risk. This aspect of resilience stands on the basic argument that the higher the rate of response resource flux into the system of risk management, the more the resources are available to the per unit time to help deal with perturbations (Wildavsky, 1991: 113). The aspect of resilience in FRM strategies ensures availability of redundant resources in response to unexpected developments of disaster risk in real flood event management. Moreover, response to determined flood risk also requires agility to reduce delays of risk management operations and unnecessary accumulation of the expected risk. Capacity to timely respond to flood risk requires infrastructure and process for FRM that would enable fast mobilisation and dissemination of resources for response to flood risk.

Resources encompass human, logistics, information and financial repertoires (Comfort *et al*., 1994). Availability of relevant information and knowledge for risk management is a resource for emergency response to flood disasters. Resources for continuous monitoring (tracking) and response to the development of flood risk can provide relevant current information to prepare in advance in response to risk. Conditions for risk information and knowledge circulation among FRM organisations and people from flood-prone communities need to be available to facilitate emergency response to risk at all disaster scenes.

Empirical findings from Chapter 5 indicate agile and timely flow of the response rate of FRM strategies. Empirical results show multiple organisations for monitoring the development of flood risk as well as dissemination of early warning and evacuation information require risk communication channels and logistics to work. Organisations monitor and provide public information and knowledge about flood risk, early

warning, search, rescue and evacuation of victims of flood disasters and property. These include the Ghana Meteorological Agency, the Hydrological Services Department, the Urban Search and Rescue Team of NADMO, and the national security organisations. These organisations monitor, give warning, search, and rescue life and property during flood events.

Empirical results suggest that the meteorological agency is the primary source of weather forecast including flood warnings. The findings further indicate a general public mistrust for weather forecasting and predictions of rains and floods. Results show that most predictions do not come true. The results indicate that logistics and technology for reliable weather forecasting do not exist. Due to this challenge, forecast about rainfall and possible flood events a week in advance is impossible although ideal. The weather station is under-resourced, making reliable and long-term weather forecasting difficult. The existing logistics and technology are helpful for daily monitoring and lead time information about flood risk. A possibility for 5 to 7 days lead time weather forecast and flood warning information would been more effective but resources for strategy do not exist.

There is relationship between weather forecast and real-time monitoring, early warning of flood and response to flood risk but the resources and logistics for advanced and realistic weather forecasting are inadequate. The findings show that poor resources and logistics of the meteorological agency can distract real-time monitoring, early warning and agile response to courses of flood disasters. This condition of the affected organisations can reduce agile and timely response rate organisations of FRM strategies.

The empirical findings indicate that organisations for rapid response are available. Security organisations have logistics for communication and response to flood disasters but they problem access to flood disaster scenes due to vehicular traffic, chaotic patterns of built infrastructure and debris of floods. This disruption reduces the rate of accessibility to flood disaster-stricken areas. Separate routes or lanes for emergency use during rapid response, free of individual vehicular use is an ideal solution but unrealistic since resources unavailable as argued.

Where there is a lack of orderliness in the patterns of the physical infrastructure and regard for emergency response teams, delays in responding to flood hazards and flood risk can be inevitable. With a planned layout of physical infrastructure and transport next, the emergency response team can promptly deal with emerging flood risk.

A condition with a potential for swift response to flood risk partly lies in the infrastructure and logistics for continuous monitoring, forecasting and warning of the course of flooding and its impacts. A 24-hour system of communication exists between this unit and other units in the military as well as other security organisations and stakeholders of FRM in Accra. Accessibility to a disaster scene in time is a major problem as a result of bad roads and inability to manoeuvre. Ability to move from the unit's base to disaster site is obstructed. Drivers and pedestrians do not respect the sound of our sirens and structures are sparely built to obscure the movement of our rescue team (SAF representative, 12th August 2013).

Hypothesis: A provision of special emergency response routes for the team of security organisations involved in search, rescue and evacuation as part of spatial land-use and infrastructure planning in the city of Accra, would prevent traffic jams and delays to improve the conditions for agile and timely flow of response rate to real flood events and enhance the current response capacity to allow for advanced resilience in FRM strategies.

The potential for testing this hypothesis lies in a future research that makes use of surveys, interviews and workshops with experts of FRM about the correlations between response and redundancy of resources availability and resilience in FRM strategies. This hypothesis is more generic and could involve stakeholders in FRM of research sites in developed and developing world cities, but limited to the city of Accra.

6.1.4 Hypothesis for resilience regarding *flatness of flood risk management strategy*

The flatness of the FRM strategy aspects describes resilience from participatory and decentralisation perspective of FRM of organisations. This aspect argues that a wider base of inter-organisational pyramid relative to the number hierarchical levels creates conditions for a more persistent function of the risk management strategies

(Wildavsky, 1991: 114). Disaster risk management involves several organisations and flatness in its structure and process can be an opportunity for key stakeholder to participate its decision making and implementation. This approach is feasible as opposed to the centralised system in the sense that, the former works well in dealing with determined disaster risk but can become rigidly overloaded with information during situations to result in poor performance. If the FRM becomes top-heavy, unforeseen events are likely to occur to poor response to flood risk and non-performance. Centralisation of decision making and implementation creates an opportunity for participation of stakeholders from various. Features of decentralisation and participation in the implementation of responses to flood risk within and among organisations become an indicator for describing this aspect of resilience.

As part of the empirical work for this research, the researcher considers decentralisation as a characteristic of flatness aspect of resilience in FRM. For operational and analytical purposes, this attribute was applied as the basic indicator for flatness of the FRM. The empirical findings further show features of decentralised decisions of organisations in the implementation of FRM strategies. This indicator was visible and explained the disaster management structure of NADMO and becomes a more reason for the coordinating function of the organisation. The results presented in the Chapter 5 of this thesis indicate that symptoms of decentralisation as disaster management organisations and committees from the national, through the regional level, and district levels play legal roles at different scales of government.

In Accra particularly, the sub-metro NADMO offices forward of flood risk report the metropolitan office for further action. The sub-metro offices of NADMO with the DVGs implement the district disaster management plan at community levels. Lessons learned from the findings of the FRM strategies at the city level describe features of decentralisation. The metropolitan disaster management committee brings relevant organisations together for disaster risk management decision-making and implementation in the city of Accra. Organisations share their expertise and once the plan is set, the sub-metro (zonal) level offices of NADMO and the DVGs become the sole implementers of such programmes at pre-flood event phase. During

flood event organisations that respond to emergencies need to converge at disaster scenes for responds. Disaster management is a security issue under the ministry of the interior. Each administrative unit also reports to its parent ministry.

Findings also indicated that the organisations at the local level have the responsibility to respond to disaster risk but the response process is linked to national level in terms of resource and national risk management decision making. Before implementation, response plans have to go through a ministerial evaluation and the send to the cabinet for approval. Then from the cabinet approval to the regional and the district levels before each department can implement policies. For instance, the NADMO bill that is purported to give the organisation autonomy to respond to the disaster has been going through the bureaucratic process since 2012 and it is yet to be approved. This process leaves many opportunities for disaster risk to accumulate or increase.

The results also show that NADMO and AMA organisation have no legal power to remove buildings on waterways unless there is a court approval. The court approval can delay for years and sometimes stall immediate response to flood risk in the city of Accra. A classic example was demonstrated by the empirical results about the removal of house on waterway at Sakama in Accra which has been litigated in a court of law for about 12 years. The results show that, decisions on FRM go through hierarchies of government, board and committees of disaster risk management which does not expedite response to unexpected course of disasters. The process slows down speed of response and encourages accumulation of the risk. Risk becomes more difficult to control during real flood events and also worsens cases of unexpected course of and impacts of flood disasters.

Hypothesis: Decentralisation of responses and sources of response resources of the NADMO and the Accra Metropolitan Area to the sub-metro levels would improve the response capacity of the organisations of NADMO and the AMA to allow for advancement of resilience in FRM strategies.

This hypothesis can be tested in a future research in the city of Accra and other developing world cities with similar conditions for falsification or confirmation. Mixed

methods approach using interviews, focus group discussions and surveys with experts of organisation in FRM could be a starting point to test this hypothesis.

6.1.5 Hypothesis on resilience regarding *Redundancy of flood risk management strategies*

This aspect of resilience takes inspiration from the argument that redundancy ensures reliability where resources are reserved, lay slack or saved for possible use during emergency situations (Wildavsky, 1991, 115). This point describes presence of additional resources within and among organisations for responsible for risk management mainly dealing with unexpected cases. The form of response resources could be intentional savings of organisations such as emergency funds dedicated to such risk. Redundant resources can also be coordinated from various organisations of public for dealing with unexpected course of disasters.

Coordination of resources may be useful for mobilising extra response capacity for dealing with unexpected risk. Redundancy of resources is a means to add extra responses beyond the expected impacts of the determined risk. This strategy creates more room to handle impacts exceeding probabilities of expected risk and impacts. The redundancy aspects of FRM strategy reflects on empirical issues of savings and backup of response resources laying for possible use during a flood crisis. Redundancy is where FRM plans are designed to contain primary capacity as well as a backup response option in case the primary fails to curtail the emerging course of disaster risk. In disaster risk reduction, the real course of disaster risk during flood event can exceed the determined probabilities of planned response. Exceedance of these probabilities could lead to flood disasters. Besides the exceedance of a probability of flood risk, a real flood event can divert entirely from the known course due to uncertainties of physical development.

Redundancy is particularly relevant during actual flood events where possibilities abound in terms of changes in the magnitude of flood events and impacts. Redundancy aspect of resilience describes disaster risk response resource backups, savings and alternatives for use in case of insufficiency of the primary response resources of the stakeholders. Redundant resources provide alternative functional channel response to the course of flood disasters in case the primary response capacity runs outs of usefulness.

The findings show that redundancy is eminent generally in the financial resources plans. Emergency disaster response funds exist for emergency use. At the national level organisations, this was particular with sector ministries who intervene to support particular destitute departments with finance and logistics. The government is the sole financier of state organisations. Findings show that national and AMA organisations do not have enough funds to keep in wait for flood disasters. They do think about the contingency that would call for more resources for response to flood risk.

NADMO as a coordination agency gets resources from private and non-governmental organisations to supplement government support. The contingency fund is a reference point to note as described previously. Besides, the DVGs of each community can be interpreted in this manner because they serve as a support or backup for the full time employed. The volunteers are the backbone of immediate response to the course of flood disasters.

International organisations such as the UN system and Federation of Red Cross in Ghana have the disaster risk emergency fund (DREF) to assist with financial and material resources in times of need. Redundancy of resources has a positive relationship with resilience in FRM strategies as it provides backup response resources to deal with unexpected flood risk and impacts. However, the administrative units of the city level hardly have redundant resources for responding to the course of flood disasters as indicated by the empirical findings of this research. Nevertheless, the stakeholders were aware of the supportive role that redundant resources can play in dealing with the unexpected increase in a flood disaster. From this relationship, the following can be hypothesised on redundancy of resources for resilience in FRM strategies.

Hypothesis: Provision of more backup financial resources for NADMO and organisations of the AMA level would increase the capacity to respond to the unexpected course of flood disasters for the advancement of redundancy aspect of resilience in FRM strategies.

To test the hypothesis, research on provision of redundant resources for the organisations of FRM from national, regional, AMA and NGOs and relationship with

resilience in FRM strategies can be conducted. This needs to involve missed methods of qualitative and quantitative research methods to text the correlation between redundancy in responses resources and advancement of resilience in FRM strategies in the city of Accra.

6.1.6 Hypothesis for resilience regarding *Buffer capacity of flood risk management strategy*

The resilience aspect, buffer capacity of FRM strategy, describes resilience as conditions to deal with possible excess threats of pre-determined flood risk during real flood events (Wildavsky, 1991). Instances of past natural disasters including floods in some parts of the world indicate that real impacts of disaster events sometimes became worse than they had been anticipated. Examples of these instances include the Hurricane Katrina 2005, Asian Tsunami, and the 2000 floods in Mozambique floods as indicated by Handmer and Dovers (2008): Comfort (1994) also explains similar dynamics and uncertainties of disasters using inter-organisational response to the Northridge Earthquake of 17th January 1994 in California in the USA. During flooding, when more flood risk and impacts are experienced than they had been pre-determined, FRM measures cannot contain the impacts without a buffer.

Buffering becomes a capacity for FRM strategies that is intentionally created to deal with unexpected course of flood disasters. Structural measures are designed to contain flood waters and regulate the direction of flow. For instance, the National Building Guide for Lightly loaded Structures in Disaster Prone Areas in Ghana (NADMO, 2011: 71) also gives codes that could make buildings waterproof. These building codes include guides of siting, building floors, roofs as well as water detention and retention facilities around buildings susceptible to floods.

The empirical results of this thesis showed that buffer zones have been part of planning for water along drains. The purpose of buffer zones is to prevent physical development on waterways but developers flout this land-use regulation to build on drains. First, there is the buffer for the primary drains. Second, the buffer zones create limit of 1 in 15 year flood line of fifteen meters wide waterway along drains for excess flood waters. The third point also highlighted the fact that the city centre has insufficient drains and detention ponds to reduce the pressure of water on the few

sewers available. The fourth point explains the fact that, despite these building and land use regulations, the buffer zones have been taken over by developers. Thus, buffer zone strategy for excess flood waters is implemented but poorly enforced.

Results further show that flood that occurs regularly is 1 in 10 years return flood events. However, drains in the city have capacity of 1 in 25 and 1 in 50 years return floods. However, there are records of 1 in 75 years return floods that occurred which lead to disasters beyond control. With issues about climate and societal changes, there are suggestions from the findings that even 1 in 100 years floods can occur.

6.2 Hypothesis for advancement of anticipation in flood risk management strategies

Anticipation in FRM strategies has been considered in this research as integral part of resilience in FRM strategies. With reference to empirical finding from section 5.2 in chapter 5, this section focuses on formulation of hypotheses for advancement of anticipation in FRM strategies of the key stakeholders.

6.2.1 Hypotheses for anticipation regarding Resistance to known flood risk in flood risk management strategy

This section shows strategies for resistance to known flood risk in FRM strategies of key stakeholders in the city of Accra. Resistance to known flood risk refers to the anticipatory FRM strategies for tackling determined flood risk and impacts. Characteristics of resistance to known flood risk illustrate the predictive component of the FRM strategies of the key stakeholders. Anticipation is basis for responding to risk before, during and after flood events management strategies.

Indicator *Specific role and responsibility of organisations*

Structural FRM measures are engineering works for the protection of flood vulnerabilities and prevention of flood hazards. Non-structural measures can regulate social behaviour and physical developments in flood-prone. Anticipation is the initial basis for putting measures in place to resist the course of flood disasters by establishing mechanisms for controlling, protecting and preventing flood risk from developing into threats to life and property. Characteristics of resistance to the

process of flood disasters account for features of anticipation in the FRM strategies that specify the role and responsibility of organisations.

The empirical findings of this research also reflect on the conditions for assessment of flood risk of FRM organisation. Empirical findings from chapter 5 show plans, protocols and policies defining roles of organisations for stakeholders of FRM strategies. Results also show that there is flood risk assessment and mapping among organisations of FRM in the city of Accra.

Roles and responsibilities of FRM organisations are an initial anticipation of what to do to prevent and reduce disaster risk. Initial requirement is to involve organisations with specific roles to deal with the problem at hand. These roles are a beginning of conscious efforts to resist the development of flood risk. As in the chapters 4 and 5, the findings of this thesis indicate there are legislative instruments mandating organisations to manage flood risk as part of the overall disaster management policies in Ghana. The national security organisations of Ghana have a nationwide constitutional order to protect life and property from disaster risk. This protection of life and property is enshrined in the National Disaster Management Organisation (NADMO) Act 517 of 1996. This Act makes NADMO a sole disaster management coordination organisation in Ghana.

Indicator *Consideration of long-term change of flood risk within and among organisations*

Results further show indicators for long-term change as in scenarios for climate and societal change impacts on flood risk. Results from chapters 4 ad 5 of this research show FRM measures for dealing with determined flood risk. Resistance approach relies on measures and instruments that are designed and implemented for controlling, protecting and regulating flood risk. Resistance strategies to a pre-flood event, flood event and post-flood event risk management are described.

Anticipation in FRM strategies refer to government projects for dealing with flood risk. The Korle Lagoon Restoration Project, which began in the year 2000, is one kind of these projects for desilting the Odaw River. The latest government intervention in FRM in the city of Accra is the Conti Project of 2012. The Conti Project shall desilt; construct and cover open drains of the AMA drainage system.

Another development for FRM is the bringing into law the national sanitation day which makes the first Saturday of every a public Sanitation Day. On this day, everyone is expected to engage in a community cleanup exercise and all businesses have to be shut until noon.

Anticipation in FRM strategies is also shown in public education using electronic, print, audio and public address system as primary means preparedness actions prior to rainfall seasons in Accra. There is door-to-door public education by the DVGs.

The results further revealed anticipation in FRM strategies with reference to structural and non-structural measures for resisting known flood risk.

These lessons included limitations of using channelisation as the main structural approach and also piecemeal funds for executing FRM projects. Consequently, FRM projects are inadequate and incomplete. Besides, the available drains for the conveyance of floods are also narrow to accommodate the volumes of water that come.

For long-term FRM also falls under the disaster risk reduction strategy as part of the Hyogo Framework for Action 2000-2015. This framework forms part of nationwide disaster risk reduction (DRR) campaign in Ghana. This campaign takes the centre of DRR and touches areas of community resilience advocacy programme.

Results show that the flood risk problems and FRM has been part of spatial planning for the city of Accra for a long time. In 1958, the first post-independence master plan for Accra was developed. The 1958 Town Plan of Accra, page number 80 explains the issues of rainfall patterns, flooding and the main drainage system at the time:

> Rainfall equivalent to 3 inches in 24 hours is an annual occurrence in Accra and the intensity of 4 inches in one hour is not unknown. Intense rainfall over a short period combined with a relative high runoff factor in developed areas and the inadequate provision for surface water drainage create annual flooding in the centre of the town. The two main drains in the town are the Odaw River, draining into Korle Lagoon and the drain between Christiansburg and Labadi, discharging into the Klottey Lagoon. Both are inadequate in size. Neither has free access to the sea and the flow is further hampered by inadequate culverts. Floods consequently occur in Adabraka, Labadi and Christiansburg. Measures to clear and canalise these two main water courses

> are most urgently required both to alleviate flooding in the respective areas and to help in the suppression of mosquito breeding.
>
> Flooding of the Central Area is particularly bad where some surface water drains converge at the junction of Independence Avenue and Barnes Road and discharge into the inadequate drain along the Knutsford Avenue.
>
> Proposals to direct this large water flow away from Knutsford Avenue and the low-lying centres of the town include a large subterranean drain running southwards under the golf course to discharge directly into the sea. The continued growth of the town and construction of new buildings and roads increases the run-off and is continuously aggravating the problem.

These issues are present in the most recent FRM policy document of Accra (see Town and Country Planning, 1962; 1991, 2012).

Similarly, findings indicate that hundreds of houses are built daily in Accra without the notice of building inspectors who go to the city to monitor such developments. The buildings spring up overnight and on weekends when building inspectors do not work:

> The people have to move out now and then to check on buildings and development structures on unauthorised lands. I can tell that, from statistics, 400 structures spring up in Accra every day. But our building inspectors are not well equipped to be able to manoeuvre and monitor these kinds of developments. This is why at times you see our people write stop work; produce permit! People can start putting up buildings overnight. Because people do not go to work on weekends, developers can start developing projects on Saturday, work on Sunday and reach some level and leave it. They can continue the project on another weekend to a period and leave it. By then, we may not even see it but immediately it has come to light that, the owner has not obtained a building permit, we would go and demolish it even if it reaches a lintel level (LND representative August 2014).

The empirical findings show that there are regulations and plans for dealing with the expected features of flood risks, which indicate anticipation in FRM strategies. There are land use regulations and laws towards flood risk mitigation in the city of Accra but these are not firmly implemented leading to encroachment and blockade of watercourses.

Hypothesis: Strict enforcement of land-use regulations and expansion of drainage by organisations of FRM from the AMA in response to features of expected flood risk would increase their response capacity for resistance to known flood risk to add to the current capacity for resistance to known flood risk to allow for advancement of anticipation in FRM strategies.

The hypothesis can be tested through a study in the Accra using qualitative and quantitative methods or regression analysis confirm or reject the relationships between continuous enforcement of land-use regulations and expansion of drainage for resistance to known flood risk and advancement of anticipation in FRM strategies.

6.2.2 Hypotheses for anticipation regarding maintenance in boundary conditions of flood risk management strategy

The research findings show a strategy of structural and non-structural measures for FRM. Maintenance of these measures is crucial for continuous functions and operations in response to flood risk. Maintenance of boundary conditions of FRM strategy becomes a descriptive feature of anticipation aspect. Maintenance refers to the practices of the key stakeholders of FRM to reduce fluctuations of flood risk and ensure continuity of their business operations of FRM. It is indicated by means for reinforcement of implemented FRM measures within and among organisations.

Indicator *Means for reinforcement of implemented flood risk management measures within and among organisations*

The means of enforcement of implemented measures for FRM is the main indicator for describing maintenance aspect of anticipation in FRM. Identifiers for this indicator considers regulations for and protocols mandatory reports and review of implemented measures and instruments that would require continuous reviews of the existing FRM instruments and measures. Once reviewed, maintenance of such measures needs to follow for their continuous functioning. Moreover, retraining of staff to update their knowledge in response to flood risk is also a useful pointer for interpretation. Empirical results of these indicators are discussed further.

The field interviews of this research included discussion about activities to clear waste from drains. It was noted that waste and physical developments on waterways

as well as siltation of drains are a major problem in Accra. As a result, the Drains Maintenance Unit of the AMA came into being. Activities for this maintenance involve clearing of waste drains, removal of physical structures on waterways, and desilting. These activities involve the mayor, the sub-metros and local communities of Accra as the following quotation demonstrates:

> Once it rains in Accra, the mayor goes out with the task force to inspect such structures on waterways and demolish them. As for desilting, it is done by the various sub-metros of the Accra Metropolitan Assembly. There are special teams of sanitation workers that do clean-up and desilting. At times, one major issue we noticed is that some of the drains are too big for the workers to desilt; they need big machines to do so. Desilting is occasionally done but this is not the best. We advise that human attitude has to change for the better. Immediately it starts raining, you would see human beings throwing refuse into the drains thinking that the water would carry the garbage away. But this debris ends up choking the drains to cause flooding (LND representative, August 2013).

Desilting and cleanups are major maintenance activities to ensure drains are free of waste and silt. Desilting is seldom done than required due to logistic constraints. The special sanitation teams do not have requisite machines to desilt primary drains. This quotation also indicates that the problem of flooding relates to the culture of inhabitants throwing garbage into drains during rainfall.

The culture of inhabitants toward urban waste and sanitation was further stressed as negative leading to deficit of waste collection to a tune of 300 tonnes daily:

> Accra is currently is generating 2500 tonnes of solid waste per day. 2500 tonnes of solid waste is generated per day and we have managed to collect averagely 2200 tonnes a day. So the difference is that we have some amount of uncollected waste remaining in the system every day. You see it, and that is the insanitation. So what we are trying to do is to encourage our private companies to bring new trucks because their trucks are old. You see and so they are not able to make the number of trips that they are supposed to make. Secondly, negative public attitude; some people even refuse to declare the waste you know they want to litter, throw it into drains and places, that is the attitude. Moreover, they do this on the blind side of the AMA. So you wake up even in the morning and you find waste along the streets, and the drains whatever. They do it on the blind side so what we are doing is to enforce our bye-laws, continue to strengthen our public education system and then effective waste collection (LWD, representative August 2014).

With regards to desilting, the Conti Project is latest of the series of work with details shown in the interview quotation that follows:

> CONTI PROJECT: "The Accra Sanitary Sewer and Storm Water Drainage Alleviation Project." Its mean aim is to make sure that the Odaw river flows into the sea, the distillation of the Korle lagoon, and then lining the channel into the Korle lagoon, we believe those are the things. There are also other drainage projects that are on-going and then we believe when those things are lined, it will prevent these incidents of flooding." Even sometimes before the rain stakeholders organise at the community level, sometimes they do general cleaning exercises. They even go to Abossey Okai in Accra to make sure on Saturday between 6 and 12 noon; all stores are closed and they encourage people to clean their environment (LRD representative July 2013).

Sanitation and clean-up activities are a policy of the city to ensure that the first Saturday of every month is devoted to cleanliness.

The results presented above suggest that there is relationship between maintenance culture and performances of designed FRM measures. Drains that are poorly maintained and choked with debris malfunction and are unable to contain flood waters. Choked drains even divert flood waters from the natural and engineered channels to areas unknown to flood risk. Lack of maintenance also leads to breakdown of physical measures to flood risk. On the other hand, well maintained engineered structures could perform their functions creditably unless the probabilities exceed their designed capacities.

6.2.3 Hypothesis for anticipation regarding *Specialisation for dealing with specific courses of flood disasters*

Specialisation for dealing with specific course of flood disasters describes the strategy of creating niches for responding to specific flood risk by taking advantage of special provisions of organisations (Wildavsky, 1991: 118).

Indicator *Sector-based approach to flood disaster risk reduction*

Disaster risk management involves sector-based approaches to deal with critical cases of flood impacts. These critical impacts require expertise of response from special sectors of the society. Flood disaster affect critical social infrastructure, health, agriculture, ecosystems among others. Flood disaster consequences on physical, social, and economic impacts require special expertise of these sectors.

Flood risk can be a threat to environmental health as post-flood disasters can bring about widespread of waterborne diseases such as cholera outbreak. Flood impacts on health include psychological disruption of people who lost valuable items and loved ones. Some psychotherapeutic response and counselling may be required. Environmental impacts of floods could be contamination of water bodies, houses and other ecosystems which need to be decontaminated. These issues therefore, explain the specific sectors and associated flood risk and impacts that require special sectoral response.

Specialisation in response to specific courses of flood disasters is discussed as a segment of the anticipating aspect of FRM. This aspect focuses on creating niches of spectacular risks of flood events based on a comparative advantage of special provisions of individual organisations. Indicator for describing this aspect is a sector-based approach to FRM. Individual sector plans for different organisations could vary to include saving of life and property, ecosystem remediation, livelihood and physical infrastructure reconstruction. The environmental protection agency for instance has the responsibility to ensure a decontamination of the ecosystem after disastrous floods. The public health directorate oversees flood risk and its impacts on the environmental health of communities. After floods, disaster is usually an outbreak of waterborne diseases such as cholera which is related to the unsanitary conditions that flood disasters bring. Flood disasters contaminate potable water and the physical environment.

The results therefore, indicate that various organisations of disaster risk management have special expertise for responding to specific risk and impacts of floods. However, many of these organisations, especially at the district assembly hardly have adequate resources to perform their functions right on time. For instance, the agency responsible for weather forecasting has no requisite technology to obtain accurate data to predict rainfall and possible flood risk with several days of lead time. Only daily forecast are offered and sometime come late. The findings of the research also show that there are flood alarms for monitoring running flood events in the city Accra. There are specialised organisations to deal with specific risk but resources are not readily available.

Hypothesis: Consideration of flood insurance in the sector-based approach to dealing with known flood risk would increase the current capacity of specialisation in organisations for advancement of anticipation in FRM strategies.

Research can be conducted to test hypothesis using surveys and regression methods to test the correlation between inclusion of flood insurance for specialisation organisations in response to flood risk and advancement of anticipation in FRM strategies.

7 Discussion of approach and key findings

7.1 Conceptual and methodological rigour of the study

The discussion in this section is on the concepts and methods of this study in relation to the broad qualitative research ethics. The research was designed to acquire authentic data to analyse the key stakeholders of FRM of the study site. It was designed to obtain data that can be trustworthy and comprehensive to describe resilience of FRM strategies in the city of Accra. In addition to resilience, the research approach also helps to understand and describe anticipation in FRM strategies for responding to expected features of flood risks and impacts.

Qualitative research approach provides researchers with in-depth data for descriptive, explanatory and exploratory case studies (Yin, 2009, 2003). For instance, Smith (1994: 491) defines qualitative research approach as "a set of tools developed to pursue the epistemological mandate of the philosophies of meaning." Similarly, Philips (1998: 265) describes it as "methodological and interpretative techniques that have been employed across a range of disciplines for many years, retaining diversity, variety and the meaning of research material." Qualitative research design celebrates the meanings that a researcher gets from the data obtained. The research design enabled the researcher to obtained expert knowledge and experiences of actors, which barely existed in the documents of FRM of the study site.

FRM, similar to general disaster risk management, has policy and operational dimensions. The qualitative research strategy enabled the researcher to discuss with FRM policy makers and implementers for expert understanding of flood risk issues in Accra. Further comprehensive understanding from these experts aassisted the researcher to point out and interpret resilience in the strategies of key stakeholders for FRM in the study site.

Qualitative research approach is associated with large volumes of data, which can be problematic to handle and analyse (Crang and Cook, 2002). In this study, the researcher encountered this challenge with volumes of relevant data from FRM policy documents and the interview transcripts. A careful reflection on relevant documents for the research topic solved this problem. Moreover, limiting the

interviews codes to the relevant themes and categories of this research helped to manage the volumnuous data.

The conceptual and practical relevance of this study can also be identifed. Yin (2009) and Eisenhardt (1989) argue that construct validity puts to test conceptual validity of a study. Yin (2009: 42) explains that “to meet the test of construct validity, an investigator” requires a specific case study area using concepts related to objectives of the study and, as well identify the operational measures that match those concepts. The single-case study design concept fit into this scientific standard. The specific theoretical concepts helped to address the research objectives and questions.

The stakeholder holder theory was suitable for the identification of the key stakeholders in FRM. This concept has been applied in disaster risk management and organisational resilience by other researchers (Franzi, 2012; Christianson *et al.,* 2009; Reed *et al.,* 2009). Franzi (2012) for instance, applied case studies approach to study FRM in Rivers and Torrents in northern Italy and used Po district River basin as a case in point for empirical work. Christianson *et al.* (2009) used a single case study approach to investigate the accidental collapse of the Baltimore and Ohio (B and O) Railroad Museum Roundhouse onto the world’s most historic and comprehensive collection of American railroad equipment in February 2003 due to snowstorm. Their research illustrates lessons of organisational management of rare events using interviews of key informants and documented records.

Reed *et al.* (2009) applied case study and stakeholder analysis strategies to categorise stakeholders in organisational management of water resources. Nchito (2015) further used case study approach to examine flood risk in the city of Lusaka in Zambia. These examples support the choice of study approach for this research. Several concepts were applied to guide the conceptual framework of this research. Chapter 3 of this study refers to the conceptual framework with operationalisation of resilience in FRM strategies illustrated in Table 1. This approach matches with similar conceptual approaches in organisational resilience and disaster risk management studies (McManus, 2007; De Bruijne *et al.,* 2010; Wardekker *et al.,* 2010; Stephenson *et al.,* 2011).

A qualitative single case study approach is relevant but criticised by some scholars. Denzin (2009) argues about challenges facing qualitative case study are a long-standing controversy among scientists. He reiterates that, quantitative scientists discredit the use of qualitative method because it lacks values for generalisation and objectivity. It must however be noted that the purpose of qualitative research is to understand a real-world problem or issue with a depth of detail. Kaplan and Maxwell (1994: 30) explain that "the goal of qualitative research is to understand issues or particular situations by investigating the perspectives and behaviour of the people in these situations and the context within which they act." Qualitative research strategy draws meaning from perspectives that quantitative approaches may lack (Yin, 1981; Denzin, 2009). The quality standards of qualitative studies emphasise the meaning of the data for answering research questions and, the procedures for data collection and analysis.

Research ethics exist to ensure that theoretical construct, external and internal validity and reliability of empirical findings are substantial issues in qualitative research. The qualitative design applied in this research permitted the researcher to review documents and interact with research participants (triangulation of data sources) for understanding FRM issues of the study site.

The multiple sources of data enabled the researcher to obtain convergence of meanings for comprehensive understanding and interpretation of resilience and anticipation. Triangulation of data from documents, expert interviews and stakeholder validation workshop offered the researcher this advantage. This convergence of data would have not been possible without applying this approach. In the words of Yin (2009: 42):

> Three tactics are available to increase construct validity when doing case studies. The first is the use of multiple sources of evidence, in a manner encouraging convergent lines of inquiry, and this tactic is relevant during data collection (see Chapter 4). A second tactic is to establish a chain of evidence, also relevant during data collection (also Chapter 4). And the third tactic is to have the draft case study report reviewed by key informants.

This quotation further elaborates the usefulness of multiple sources of data for case study research in social science. Additionally, this detailed understanding facilitated derivation of hypotheses.

A scientific research begins either with a strong theory or without a grounded theoretical foundation (Eisenhardt, 1989). The inductive research design helped to derive hypotheses from the empirical findings. The basis of this choice is not far-fetched from scientific practices, since the theoretical basis of resilience in FRM strategies is yet to be established. The hypotheses can promote theoretical development of the resilience concept in the future. The inductive research design would create opportunity for future research on resilience in FRM. It offered opportunity to formulate a conceptual framework for operationalisation of resilience in FRM strategies. Inductive study, starts on the grounds of contributing to the development of theory or concepts in a field of study (Yin, 2009). This strategy is a useful design for research on a topic where fresh perspectives are needed (Eisenhardt, 1989); and it is rightly so for this study.

The concept of resilience in science and practice, especially in the realms of FRM strategies, and disaster management in general, is at its growing stage in international discussions (Brand and Jax, 2007; ISO 22301, 2012; Hyogo Framework for Action 2005-2015; Sendai Framework 2015-2030). Eisenhardt (1989: 549) discusses the contributions of case studies to concepts or theory development in science and argues that:

> … strong studies are those which present interesting or frame-breaking theories which meet the tests of good theory or concept development (e.g., parsimony, testability, logical coherence) and are grounded in convincing evidence. Most empirical studies lead from theory to data. Yet, the accumulation of knowledge involves a continual cycling between theory and data.

However, inductive research design does not necessarily imply that the research is devoid of concepts that define its scope and focus (Yin, 2009). The inductive approach as applied to this study is not based on the grounded theory approach of Strauss and Glaser (1978). Grounded theory sometimes gives an impression that an inductive research begins entirely with no conceptual ideas that guide the study (Eisenhardt, 1989). The conceptual framework of this research is formulated from literature review and extant concepts of resilience in in the fields of FRM and organisational risk management studies. The researcher synthesises various perspectives of scholars in these fields as conceptual basis for the empirical work and the development of the hypothesis.

There are also critical arguments for and against qualitative case study research strategy. Miles (1979) argues that “qualitative data are noted for serious weaknesses and problems as well” referring to the lack of clear data, analytical procedures, the large volumes of data and the poor credibility in drawing generalisable conclusions from findings. Matthew Miles concludes that, qualitative research and case study lack a creditable rational scientific approach (Miles, 1979). Yin (1981), in a response to the work of Miles (1979) about qualitative data as an attractive nuisance alludes to the challenges facing case study research strategy but argues for ways to get around such crisis. Arguments provide answers for credibility and prospectus strategies to cope with the challenges of a qualitative case study approach. Yin (1989: 60) explains that, “at the outset of any case study, there is an unfortunate tendency for the initial write-ups to be based on the data elements in the study.

The pitfall is in spending the inordinate time and effort to construct readable narratives for such data elements, unless a study specifically calls for publishing these materials. Instead, any narrative accounts should be organised around the substantive topics of the case study.” Similarly, this study applied this strategy to cope with the voluminous data obtained from the fieldwork for this research by defining codes and building narratives around the main themes of the thesis topic.

The researcher also reflected on the claims that a qualitative single case study results relevant for generalisation due to its small sample size (Yin, 1981, 2003). These criticisms are partly incorrect because a qualitative single case study is not necessarily a survey or statistical research with an aim to make general predictions. Yin (2009: 38) explains two types of generalisation in case study: statistical and analytical generalisations, and notes that “a fatal flaw in doing case studies is to conceive of statistical generalisation as the method of generalising the results of your case study.” Yin (2009: 38-39) contrasts analytical generalisation with statistical generalisation that:

> … in statistical generalisation, an inference is made about a population (or universe) on the basis of empirical data collected about a sample from that universe. This method of generalising is commonly recognised because research investigators have ready access to quantitative formulas for determining the confidence with which generalisations can be made, depending mostly upon the size and internal variation within the universe and sample. Moreover, this is the most common way of

> generalising when doing surveys. … Analytic generalisation can be used whether your case study involves one or several cases, which shall be later referenced as single-case or multiple-case studies. Furthermore, the logic of replication and the distinction between statistical and analytic generalisation will be covered in greater detail in the discussion of multiple-case study designs. The main point at this juncture is that, you should try to aim toward analytic generalisation in doing case studies, and you should avoid thinking in such confusing terms as "the sample of cases" or the "small sample size of cases," as if a single-case study were like a single respondent in a survey or a single subject in an experiment.

As a qualitative single case study, results of this study are not meant for statistical generalisation. However, the conceptual framework from which interpretations can be a useful reference point and contribute to the scholarly debates on resilience in FRM strategies and disaster risk reduction in general. Particularly, the interpretation of the data falls within the aspects of resilience and anticipation in FRM strategies, which have conceptual significance.

The researcher strategically chooses a single case study approach to conduct an in-depth research within the limited duration of the empirical work. According to Eisenhardt (1989), a case study can be either a single case or multiple cases (also see Mathew and Miles, 1984; Yin, 1984). Instances of single case studies cited includes the crisis of missiles in Cuba by (Allison, 1971) and a research about decision making on British retailers by Pattigrew (1973), and many recent single case studies on disaster risk management (Kuhlicke, 2013; The World Bank, 2012). Based on the strengths of studying multiple organisations involved in FRM as units of analysis, the researcher has been able to get comprehensive data for understanding and explaining the focal issues of this research. In sum, the aim of this study is not to offer statistical generalisation. Yin (2009: 43) explains clearly that:

> Critics typically state that single cases offer a poor basis for generalising. However, such critics are implicitly contrasting the situation to survey research, in which a sample is intended to generalise to a larger universe. This analogy to samples and universes is incorrect when dealing with case studies. Survey research relies on statistical generalisation, whereas case studies (as with experiments) rely on analytic generalisation. In analytical generalisation, the investigator is striving to generalise a particular set of results to some broader theory.

Content analysis was applied to analyse the data of this study. This strategy for the data analysis further influenced the scientific quality of this research. Content analysis is useful for analysing qualitative data; including interview transcripts, video tapes, protocols of observation and documents (Mayring, 2000). The author further puts forward that, content analysis has a long history in social science research - it is one of the main methods of data analysis. This strategy has the aptitude for handling large volumes of texts as sources of data. This thesis makes use of content analysis to analyse the empirical data from the interview transcripts and the documents. The method is suitable for inductive and deductive research (Mayring, 2000; Crang and Cook, 2002).

As an inductive research, this research required an approach that could suitably handle the volume of text obtained and reduce it to analytical format. Content analysis requires coding of the data into themes and categories for easy and relevant data analysis. The use of selective coding strategy to organise the data into relevant categories and themes facilitated the analysis. The approach tremendously saved time and the data fits into the strategy of content analysis. This strategy provides the researcher with opportunity for analysis through pattern matching and rival explanations. Pattern matching and rival explanations enable the research to find points of saturation of arguments and divergence to the common arguments in the empirical data. These analyses further contribute to the internal validity of the research findings. Internal validity is an essential component for testing the quality of a qualitative research as this proves the trustworthiness of the analytical process and the rigour of the analysis.

Research work includes series of protocol and documentation of the methodological procedures in the research design (Yin, 2009). Besides ethical underpinnings, this process rigorously tests the reliability of the research findings. This research underwent series of protocol and documentation as part of the methodology in accordance with the social research ethics and to fulfil community entry process in the research site. The letters of introduction sent to the research participants' organisations open opportunities for access to data and the interviewees. These letters confirmed the legitimacy of the research and the researcher. FRM as part of disaster management is coordinated by the National Disaster Management

Organisation (NADMO) of Ghana, under the Ministry of the Interior. The researcher discovered that the coordinating agency and other high ranked authorities might be resourceful for getting access to data. A letter of introduction was obtained from this ministry and district office of NADMO at the Accra Metropolitan Assembly to get access to the key organisations and their representatives.

The use of the semi-structured interview guide as the main primary data collection tool offered additional opportunity to increase access to the relevant data for this study. Semi-structured interviews are regarded as a useful method for social research. Galletta (2013: 24) aptly sums up that:

> Semi-structured interview provides a repertoire of possibilities. It is sufficiently structured to address specific topics related to the phenomenon of the study while leaving space for participants to offer new meanings to the study focus. A key benefit of the semi-structured interview is its attention to lived experience while also addressing theoretically driven variables of interest. The semi-structured interview offers great potential to attend to the complexity of your topic. It allows for the engagement of the participant with segments of the interview, each progressively with more structured.

These benefits of the semi-structured interview used in this dissertation enable the researcher to explore expert information about the FRM strategies of the key stakeholders in the study area. The structure of the interview guide as a data collection tool captures the relevant aspects of the resilience aspects of FRM strategies. This structure further ensured that interviews focused on main components of the research.

Given the conceptual and methodological experiences of the researcher with the chosen research design and methods in this section as basis, the next section focuses on specific empirical findings of this study. The main findings are put in the broad context of the thesis.

7.2 Conceptual and empirical relevance for resilience and anticipation in flood risk management strategies

The focus of this section is to discuss the main findings that explain the specific relevance and challenges for FRM strategies. Details of this section are discussed

beginning with the concept of resilience and it operationalisation in disaster management, followed by the specific relevance (and challenges) for FRM strategies and new insights obtained from the empirical findings.

Among the key findings of this study worth discussion, is the framework for operationalisation of resilience in FRM strategies. The framework was formulated from a review of literature on concepts and application of resilience in organisational risk management. A major attribute of the framework for operationalisation of resilience in FRM strategies is its generic description of the meaning of the concept in disaster risk management. Flood risk is a climate change and human induced disaster risk with potential for frightening impacts that catch the attention of international, national and local organisations (The World Bank, 2012; IPCC, 2014; UNISDR, 2005-2015, Sendai Framework 2015-2030).

The framework generally focuses on the resilience in strategies of the key stakeholders of FRM. The stakeholders of FRM also deal with other forms of disaster risk. The research reveals that National Disaster Management Organisation (NADMO) of Ghana coordinates organisations and resources for management of all disasters. The establishment of NADMO to coordinate management of disasters is not unique to Ghana. It is similar to disaster management agencies, institutions and commissions in other countries that were formed prior to the declaration of the International Decade of Natural Disaster Risk Reduction in the 1990-1999 by the United Nations International Strategy for Disaster Risk Reduction (O'Keefe *et al*., 2006; Waugh & Streib, 2006; Djalante, 2012). O'Keefe *et al.* (2006: 65) confirm the existence of institutional structures for dealing with climate change risk and explain that, in developing countries

> … an approach to risk and disaster management also exists, at least on paper. It involves commissions and institutions at the national, sub-national, regional and municipal level, which have proliferated since the beginning of the International Decade for Natural Disaster Reduction (IDNDR) (1990-99).

Flood risk falls under the general disaster risk management and sustainable development planning policies and programmes. The framework, although uses flooding as an example, can be replicated for the management of other specific

natural and human-induced disaster risk like drought, fire outbreak, hurricanes and earthquakes.

The operationalisation of resilience in FRM in this research also captures features of structural and non-structural measures for disaster risk management. The aspects, indicators and identifiers of resilience and anticipation in FRM strategies apply in the context of before, during and after flood event management. The framework considers the strategies for dealing with unexpected course of flood disasters, in addition to features of expected flood risk and impacts. Literature and policy documents refer to uncertainties in flood risk as major cause of growing risk in recent decades. Likewise, there is also the determined component of the disaster risk, which can be anticipated and prevented (Hollnagel and Woods 2006). This sums up the proposition of Wildavsky (1991) on the need to combine the principles of resilience and anticipation for resilient organisational disaster risk management in general. The specification of the aspects of resilience in FRM strategies is a useful for management risk from from a running flood event. Wardekker *at al.* (2010) similarly applied the concept of resilience in dealing with climate change related risk and concluded with foresight and preparedness planning as additional properties of resilience.

Kendra and Wachtendorf (2003: 49) examined the features of resilience of the Emergency Operations Management and Emergency Operations Centre response to the World Trade Centre attack in September 2001, and they showed similar agencies involved by postulating that: “The case of New York demonstrates that, rather than being conceptually distinct, anticipation is an integral dimension of resilience. The distinguishing feature concerns what is to be anticipated.”

Specifically, the framework looks into individual and inter-organisational capacities for dealing with the unexpected course of flood disasters. This dual character of the framework offer possibilities for its further development and application in the management of risk within individual and among multiple organisations. Moreover, in disaster risk management, especially in an emergency response, it is common to have the same organisations with a mandate to hydro-meteorological, seismic, fire and similar hazards that affect life and property all together (Comfort *et al.,* 1994). Thus, the framework for the operationalisation of resilience in FRM strategies can be

a useful basis to inform the application of resilience for organisational management of a particular risk, be it natural or human-induced.

The conceptual framework further captures process of FRM involving the analysis, assessment, and reduction of flood risk. The resilience aspects consider issues of diversity in the sources of responses and resources. The sources of responses and resources for dealing with the course of flood disasters underscore to the multiplicity of FRM stakeholders coming from different levels of government and variety of response resources from various stakeholders of formal and informal organisations.

The next general point of the framework is the agile and timely response to flood risk. This reflects on not only the emergency disaster management but also the preparedness and post flood event phase. More particularly, the emergency response phase is where a quick mobilisation, distribution and redistribution of response resources required the emerging flood disasters and impacts. At this stage, there is little avenue for delay in response. This is a fragile phase and flood risk can spread across space and time if there is any shortage in the supply and deployment response resources. The framework further addresses issues of stakeholder involvement, considering decision makers and implementers, and the general public. The conceptual model is, therefore, a broad scope that reflects on FRM strategies in general terms.

One shortfall is that, the conceptual framework was not tested in the study. However, the hypotheses can be tested in future research for its feasibility. The framework is more generic and cannot be prescriptive; it needs to be tested and proven. Thus, findings of the study are not blueprint for management of floods in other cities.

New insights could also be drawn from the framework of operationalisation of resilience in the FRM. Specification of aspects of resilience and anticipation in FRM strategies was challenging but a useful task. Aspects of anticipation mainly describe structural and non-structural measures but lack the quantitative measuring rod. A hybrid of qualitative and quantitative means of describing a measure could have reduced the complexity in the management. FRM has multiple stakeholders and involves the local city formal administration and the informal stakeholders. The challenge is, the flood prone communities also formulated their community

development associations as formidable platform to contest any FRM policy that aims at evicting occupiers of flood-prone zones.

7.3 Accomplishment of the research objectives and answers to the research questions

This section discusses the degree to which the research findings address the research questions and objectives. Also, lessons learned from the approaches applied are discussed. The main research question aims at describing the response capacity of the key stakeholders of FRM for dealing with the unexpected course of flood disasters and the expected features of flood risks in their management strategies. The research question 2 specifically focuses on capacity of key stakeholders in responding to unexpected course of flood disasters in FRM strategies. To accomplish the main research question and objectives, three specific research questions, with corresponding research objectives were developed. The empirical findings address each of these questions. This discussion provides the answers to research question and explains question one.

RQ 1: Who are the key stakeholders of flood risk management in the city of Accra?

Research question 1 refers to the identification of the key stakeholders in the FRM in the city of Accra. This is accomplished by the analysis of their legitimacy, roles, influence and urgency in FRM. The answers to the first research question reveal that the key stakeholders of FRM are international, national, regional, district, traditional authorities NGO; and business organisations. Key stakeholders have legitimacy, roles, influence and urgency in FRM. Interestingly, traditional authorities, slum communities, and Slum Union of Ghana are represented in AMA disaster management committee that takes decisions and implements FRM plans in Accra. Other studies have found that FRM is a multi-stakeholder affair involving international, national, and local government authorities, as well as non-governmental organisations and the private sector actors (Fans, 2010; Kuhlicke, 2010; The World Bank, 2012; Djalante, 2013). A case study by Kuhlicke (2010) in municipality of Rivertown in Saxony, Germany, reveals multiple institutions from state, regional and municipal levels involved in the emergency response to the

August 2002 flood event. Djalante (2013) mentions that disaster risk reduction in Indonesia as a multi-stakeholder venture. The World Bank (2012) also confirms that, similar to principles of the International Strategy for Disaster Risk Reduction (Hyogo Framework for Action 2005-2015; Sendai Framework for Action 2015-2030), disaster risk management involves multiple stakeholders. This research found that the main FRM body of Accra is the Accra Metropolitan Disaster Management Committee, consisting of national and AMA organisations. This committee does not have official representatives of local traditional authorities, Slum Union of Ghana and Old Fadama Development Association, although they play important roles in flood management in the city. These organisations wield legitimacy in flood-prone communities. These groups are involved at the strategy implementation stage of FRM through consultation. Several reasons could account for this partial involvement of those stakeholders.

One can argue that these organisations are not part of the metropolitan administrative set up and have no legal mandate in urban development planning and management. However, these organisations play legitimate roles with influence and urgency in FRM especially the preparedness, emergency and post disaster management phases (O'Brien *et al.,* 2006). For instance, successive government policies and projects for the eviction of and relocation of flood-prone communities in Accra have not been successful since the year 2003 due to protests and demonstrations against the projects. The key stakeholder status of these organisations in FRM can be explained from Schuman (1995) popular argument of stakeholder legitimacy, which considers legal, moral and social dimensions. These stakeholders are traditional and local symbols in the communities. Flood-prone communities and civil society organisations also exert influence on FRM programmes. Eviction of settlers from flood-prone communities is distressful for flood victims. It results in homelessness and joblessness. Eviction is also a human rights issue and attracts urgency and concerns of human rights activists groups, internationally and locally. Demonstrations against eviction have successfully led to discontinuation of some of the programmes.

Bryson (2004) acknowledges that stakeholder involvement in policymaking and implementation is a political issue that needs careful treatment. Objective of

stakeholder analysis is to ensure success in management. Participation of many stakeholders in risk management is also problematic and criticised as unrealistic. Thus, stakeholders who have attributes of legitimacy, roles, urgency and influence in FRM need to be identified for effective decision-making and implementation.

RQ 2: How are these stakeholders dealing with the unexpected course of flood disasters in addition to the expected features of flood risk in their management strategies?

The second research question sought to analyse the resilience in FRM strategies of key stakeholders in responding to unexpected course of flood disasters in addition to features of expected flood risk. The question also refers to anticipation in the FRM strategies. The question sought answers that qualitatively describe aspects of resilience in FRM strategies by referring to respective indicators and identifiers. Overall, the results answered the research question and fulfilled its objective. Answer reflected response to the unexpected course flood disasters in addition to the features of expected of flood risk in FRM strategies of organisations. Empirical finding on resilience and anticipation in FRM strategies indicate potentials and limitations as well.

Omnivorousness, referring to diversity in FRM strategies was indicated in the capacity of organisations from international, national, regional, district, traditional, NGOs, and business backgrounds responding to flood risk and impacts in the city of Accra. Diversity is reflected in international policies for disaster risk management, such as Hyogo Framework 2005-2015 and the Sendai Framework for Disaster Risk Reduction 2015-2030 (UNISDR, 2005, 2015; Djalante, 2012).

Diversity further refers to sources of responses for dealing with unexpected course of flood risk. Multiple sources of ideas, material, logistics and human resources can be potential strengths of diversity in FRM. It describes potential for advancing resilience in FRM strategies through many responses to flood risk (Resilience Allianz, 2010; WMO, 2007; Waugh, 2013). Diversity in FRM strategies revealed that multiple responses exist to deal with flood risk concurrently. In response to flood event, command and control from security organisations is applied. Early warning involves, print and electronic media and personal informants in the form of disaster volunteer groups. The strategy for post flood disaster impact recover involves mobilisation of

relief aid to victims from international, national, regional, NGOs, business and traditional organisations. Waugh (2013) argues that emergency response to disaster risk inevitably involves multiple partners whether formal or informal institutions, individuals, groups, local or international.

A critical look at diversity in the formulation of the FRM strategies shows a limitation to formal administrative organisations and technocrats. Informal institutions are sidelined to the implementation of disaster risk management strategies. The diversity of the structural measures is also limited mainly to use of drainage channels for conveyance of floodwaters.

Findings revealed resilience in FRM strategies with reference conditions and and process for agile and timely response to the unexpected course of disaster risk. Evidence refers to coordinated responses among organisations of FRM strategies especially security agencies and the Urban Search and Rescue Team of Emergency Operations Unit of NADMO. Furthermore, in theory, 24-hour operations centre exists for response to flood risk and other forms of disasters. At disaster scenes, emergency operation centre is set up quickly for information collation and distribution among various security agencies and the public.

Emergency phone lines and disaster management website of NADMO are also means of exchanging emergency disaster risk information between the public and the manager of disaster risk. These structures and process also reflect in the works of Djalante (2012) and Waugh (2006). Safe havens are pre-determined for emergency response situations. Radio and “GoTa” (pager system) of communication links the emergency response teams to facilitate communication. This phase of management involves command and control, as well as coordinated collaboration strategies. It was learned that there is flexibility in the response process and this helps to facilitate quick action.

Findings describe this state as crucial since unexpected situations such as time of flood occurrence, magnitude of impact, specific location, and inability to move to hotspots of disaster scenes in time due to unplanned built environment, maroons and blockage cut-off of routes to these scenes. Helicopters, engine-boats and fast

moving vehicles are means through which search, rescue and evacuation team can move to flood scenes safe life and property.

Agile and timely response also refers to decentralisation as a strategy for quick flood risk. NADMO is the main coordination organisation and has its offices in the metropolitan assembly and the sub metros of Accra. This extended to the establishment of the DVGs at the local communities for risk monitoring, public education and first frontline respondents to emergency floods. Delay in FRM policy formulation and implementation limit decentralisation strategy. FRM policies go through hierarchies of government involving presidency, cabinet, parliamentary and ministerial committee approvals before taking effect.

A typical case is the bureaucratic process that involved in the approval of the NADMO Bill since 2012, which seeks to obtain absolute powers for the agency to response to hazards and vulnerabilities on the spot. The current powers of NADMO allow the agency to play only coordination roles. When risks are identified, they must be delegated to the district assemblies who have the power to respond. The expected response from these assemblies delays and sometimes does not occur at all. This delay explains the springing up of buildings and choking of waterways leading to floods during a rainfall event. Across developing world, these are common causes of flood risk and disasters (UN-Habitat, 2011; The World Bank, 2012).

The research findings further show characteristics of homeostasis, in terms of the strategic processes and platforms for collaboration (coordination) and networking among the key stakeholders in the formulation and implementation of FRM strategies. At management level, the directors of administrative units and organisations of FRM, constituting the disaster management committee meet periodically to discuss the disaster risk facing the Accra metropolis. Flood risk is one of top priorities of the committee. This committee is the platform for sharing expert knowledge from various sectors in the FRM. Disaster management committee are platforms for sharing information and advancing knowledge of disaster risk such as flooding, which is a common phenomenon in many countries.

Djalante (2012) refers to similar platforms in his case study to test the implementation of international disaster risk management policies of Indonesia. The

sub-metros, through the NADMO offices do inventory of flood risk and make recommendations to the AMA for mitigation. The process of communication among management is through radio, memos, and phone consultations. By protocol, all the sub-metros must submit quarterly memos and reports on FRM in their respective areas to the Accra Metropolitan Assembly. This approach is purported to ensure continuous tracking for flood risk and provide solution. However, implementation of the FRM is another component that hardly becomes known. Reports are often submitted, but actions for mitigation get delayed, leading to unforeseen inundations of communities. The unexpected course of flood disasters was also shown in the discussion. Experiences with previous flood incidents proof that gutters get choked and subsequently, divert rainwaters off course to cause flooding.

It was also known from reports and the interviews that flood event could trigger fire outbreak. The classical example of this unexpected instance is the 3rd June 2015 floods which led to the death of more than hundred as a result of gas explosion in Kwame Nkrumah Circle, a suburb of Accra. The loss of lives and damage to property could be attributed to a sudden collapse of buildings and falling of trees or their branches. Electrocution is also common. The city authorities engaged in preparedness activities to identify hazards and educate the public about these consequences before the rainfall seasons.

One major finding from this research on the unexpected course of flood disasters was the issue of people building at nights and on weekends as a strategy to evade immediate interruptions by law enforcers of the land-use regulation body, and build on unauthorised lands. The city authorities hardly determine these activities until at their matured stage and/or after flood event. The results also showed that it is not all flood events and areas of inundation that can be usually anticipated beforehand. This was buttressed by the expression that *flood disasters have no timetable and can occur at any time and areas (GRCS representative, August 2013)*. National and regional disaster platforms for awareness creation exist to facilitate exchange of information between the flood risk managers and the public.

One could argue that flood risk managers are aware of unexpected flood hazards, vulnerabilities and risk that lead to sudden disasters. However, resources and the political-will seem to be a challenge, leading to implementation problems. Waugh

(2006) and the World Bank (2009) argue similarly that the developing world has the administrative structures but lack the resources and technology for disaster risk management. The metropolitan assembly has inadequate personnel and financial resources to execute these plans.

Coordination of activities among the government authorities, the private sector and communities that influence FRM strategies looks bad. Some utility service infrastructures cross-waterways and it is common to see debris in drain and buildings on waterways in the city of Accra. The coordination among government agencies is limited to the level of policy formulation. Implementation of FRM strategies needs the coordination of activities of key institutions that influence the functions of the FRM measures. Flouting of building codes has a long history leading to disasters. Many developing world cities have problems with implementing land use regulation and building codes effectively.

Findings also indicate resilience regarding flatness in response process and structure of FRM strategies. Flatness refers to FRM strategies that allow organisations to respond to floods at local level and create opportunity for participation of key stakeholders. Flatness, in the sense of decentralised governance lies in the heart of district assemblies' concept in Ghana. The results suggest that the Accra Metropolitan Assembly has the power and responsibility as local government to formulate and implement FRM strategies in the city. The flatness goes down to include the sub-metro offices of Accra. However, the financial resources to implement FRM projects come from sector ministries and national government. In other cases, climate change related risk reduction funds come from donor agencies. Donor and international development agencies are the major financiers of such projects in developing countries (The World Bank, 2012).

The district assembly development subventions do not come early enough for timely investment in risk reduction projects. Delay in receiving the funds means inability to implement FRM plans. At times, the monies are supplied but sufficient to complete projects. Consequently, projects get stalled or finished in piecemeal, and too late to serve their intended purposes.

Findings revealed resilience in FRM strategies, referring redundancy in response resources of organisations. Characteristics of redundancy are visible in the size of drains contain 15-50 years return flooding although the usual floods experienced are 10 years return flooding. In terms of emergency response staff, volunteers groups are trained to assist in times of shortage of employed staff in disaster management organisations. However, there is lack of money to sustain these volunteers. In terms of redundancy of financial and materials for relief, there was no evidence at the metropolitan assembly. Relief comes from the regional and national offices of NADMO. The resources are usually inadequate for organisations to have reserves or savings. Emergency funds may come from sector ministries to support departments and agencies in need. Financial and material resources are also sought from private organisations and donors in preparedness phase and for emergency response needs.

Resilience in FRM strategies was revealed in the findings regarding buffer for excess floodwaters. This is seen in land use regulations that create space for floodwaters of about 15 meters. In such zones, no development is allowed. However, residents occupy the 15-meter buffer zone. It is common to see properties on shoulders of drains and in waterways.

Specific sector organisations create niches by special training to respond to special risk of floods. The search and rescue teams particularly need to be specially trained and retrained annually to sharpen their skill for emergency flood response. Scenarios for rapid response to emerging risk are created for trial response. This aims to facilitate awareness of complex issues that might emerge. Similarly, workshops are also held to brainstorm strategies for responding to emerging flood risk. The available evidence suggests that in the policy formulation, some of these characteristics that describe the aspects of resilience in FRM strategies exist. Nevertheless, their implementation is slow due to poor enforcement and inadequate resources. Inadequate resources and poor implementation of policies and programmes are common problems that face development in many countries.

Features of anticipation also exist in the FRM strategies, but inadequate to commensurate the growing flood risk in the city of Accra. The idea behind engineered works in FRM is to prevent determined flood risk from occurring. This

objective cannot be achieved when flood risk projects are inadequate, poorly maintained or malfunctioning. Evidence shows that the main engineering approach is channelisation. However, the channels are inadequate and are not regularly maintained. Drains are choked with debris and built structures. Urban waste management overwhelms the waste management department and the private agencies.

Results show a lack of culture of maintenance for public infrastructure and waste management. Usually these structures are done in a piecemeal manner by subsequent government in reaction to flood disasters, hence there is hardly a city or region-wide master drainage project to cover the entire city of Accra and its surroundings. Yet, development keeps expanding into known wetlands of the city. Uncontrolled physical development and land use is a major problem facing development world cities, including Accra. Uncontrolled development comes with haphazard land acquisition and chaotic built environment. These findings provide insights for prospects of resilience in FRM strategies. These insights are explained in the next section.

RQ 3: How could the capacity of the strategies for responding to the unexpected course of flood disasters be advanced?

The objective of the research questions is to derive hypotheses on the meaning of resilience aspects for the advancement of the FRMstrategies in the city of Accra. Accomplishment of the objective is based upon empirical findings for aspects of resilience and anticipation in FRM strategies presented in chapter 5 of this study. The research findings answer the third research question of this study and its objective. The research findings reveal aspects of resilience in FRM strategies as shown in section 5.1. Hypotheses for advancement of resilience in FRM strategies were derived from the empirical findings. Section 5.2 shows empirical findings from aspects of anticipation in FRM strategies. Reference to these findings yields hypotheses to promote anticipation in FRM strategies for advancement of resilience. The derivation of the hypotheses refers to the operationalisation of each aspect of resilience and anticipation in FRM strategies and subsequently point to relevant empirical findings. Explanation of the findings shows strengths and weaknesses for resilience and anticipation in FRM strategies. The hypotheses then follow to propose

a scientific guess for improvement on the weakness for advancements of resilience in FRM strategies in the city of Accra.

The hypotheses provide avenues for testing through to be tested through future research. Specific reference is made to the approaches to conducting research on each hypothesis. Particularly, relevant research methods and research participants are proposed to test the hypotheses in the future. This seems to be a catalyst for further research development of the conceptual framework applied in this research.

7.4 Limitations of this research

Although this study provides practical and conceptual relevance for resilience and FRM strategies, it has limitations that must be mentioned. The research design and objectives of the study limited this study to specific focus within a period. This limitation, culminating with limited resources restricted the focus of the study. Specific limitations are derived from objectives of this study.

First, this research mainly identified key stakeholders of FRM in the city of Accra. It only focused on organisations as key players in FRM strategies but did not extend to include individual citizens. This could be a limitation because it could happen that individuals can play major roles in FRM. Indeed, individuals as victims of flood disasters can affect FRM by taking personal initiatives in response to flood risk (Buckle and Chevalier, 2008). However, individual people response to flood risk is outside the focus of this study.

The research design is a single case study and was limited to city of Accra. Thus, the findings can have limited generalisability (though not impossible) to FRM in other cities. Consideration of multiple case studies might be more practical for generalisation. However, this was not possible due to the time constraints. Conceptual contributions of the study might show some limitations. The framework considers FRM strategies of key stakeholders in a more generic way and did not apply to a flood event. Nevertheless, this focus might offer some advantages for FRM in the future.

In addition, the framework for operationalisation of resilience in FRM strategies was not tested in this research. Testing of the framework was not possible within the

timeframe of this study. The framework requires to be tested to confirm its conceptual generalisation.

The focus of this research was generic and did not do a detailed analysis of resilience in FRM strategies of a single organisation. This would have allowed the researcher to interview several staff in each organisation for more crosscutting understanding rather than limiting the interviews to managers of the organisations in FRM. Staff who occasionally performs frontline responses would have added their practical experience to this discussion. However, the focus of the study was only on experiences of individuals of the organisations who participate in decision-making and implementation of FRM.

7.5 Prospects and challenges for future research on resilience in FRM strategies

In this section, relevance of the research findings for future studies is discussed. Insights from the results indicate lessons for prospects for research on resilience in FRM and its operationalisation. Lessons for future research are not strict normative prescription for resilience in FRM strategies and its operationalisation. Future research to test the framework and the hypotheses can add more meaning to resilience in FRM strategies and its operationalisation.

These lessons are visible in the hypotheses that call for further testing through a multiple case study approach. If future research on resilience in FRM strategies involves several cities across the developing world with socio-ecological features as Accra, it could yield feasible results for theoretical and practical generalisation in response to flood risks across boundaries.

The lack of common meaning for resilience and its application in science is a major challenge for operationalisation of resilience in FRM strategies but at the same time, it is an opportunity to gain lessons from this study. The dearth of a one-size-fit-all conceptual framework for the operationalisation of resilience means a need for more explorative research. Operationalisation of resilience in FRM strategies of this research is initial step to further work in the field study. Although the conceptual framework of this research specific for FRM strategies, it can be adapted for management of similar risks from hydro-meteorological hazards. Aspects of

anticipation in FRM strategies have implications for structural and non-structural measures in response to determined flood risk. Response to flood risks requires resilience in FRM strategies to deal with unexpected impacts of floods that occur before they get detected while anticipation in the strategies deal with determined flood risk to prevent, protect or mitigate flood hazards, vulnerability and exposure. Aspects of resilience and anticipation in FRM strategies both help to advance capacity of key stakeholders in response to flood risk and impacts.

A major challenge with the conceptual framework is the generic nature, making it more open and less normative. Future work involving multiple case studies might be worth testing. However, resilience in FRM strategies and its operationalisation are meant to explore response capacity of key stakeholders for dealing with unexpected course of flood disasters, which is often neglected.

This study applied a single case study research approach to (inter-) organisations in FRM in the city of Accra. This helps to understand inter-organisation management of flood risk of the study site by specifying the organisations in FRM and their strategies of resilience and anticipation. However, this research did not focus on the management of flood risk in individual organisations. Detailed case studies of resilience in strategies of each organisation in FRM might be more useful for theory and practice. Moreover, case studies focusing on response of these organisations to a single flood event in the city of Accra may also be beneficial for understanding and analysing the capacity for dealing with flood events. A study on management of a single flood event could be an avenue for testing the relevance of resilience in FRM strategies and key stakeholders in FRM.

In summary, the Chapter 7 is a discussion of the findings from this research. The discussion focused on the conceptual, methodological and practical relevance of the findings. It spells out the accomplishment of the research objectives and answers to the specific research questions. In addition, limitations and prospects of the findings are discussed. Next is Chapter 8 on the conclusions and recommendations from this research.

8.1 Conclusions on main contributions of this study

The research was set to identify key stakeholders of FRM and to describe resilience in FRM strategies in the city of Accra in Ghana. Key stakeholders are a pivot around which resilience in FRM strategies can evolve. Recommendations are made for advancing resilience in FRM strategies and direction for future research.

This research provides timely contribution to deal with uncertainties in flood risk and impacts. Uncertainties in probability of occurrence and impacts of floods get worse as a consequence of climate change and societal developmental changes. This research on resilience in FRM strategies is timely as it contributes to discussion on the management of unexpected course of flood diasters as a problem of international concern. Besides, research on resilience in FRM strategies and disaster risk management in general is conceptually disintegrated with no common agreement in the meaning and application. The lack of solid theoretical basis leads to challenges for common understanding and operationalisation of resilience. Particularly, operationalisation of resilience in FRM strategies was challenged by limited scientific work, especially from developing world.

Moreover, existing research on the topic in the developed world focuses more on structural measures for FRM than on non-structural measures. This means FRM strategies give priority to features of expected flood risk over unexpected course of flood disasters. In real world, however, unexpected course of flood disasters, which become manifest during flood events, are inevitable and need to be considered in FRM strategies of key stakeholders. This study considers resilience and anticipation in FRM strategies as a step forward for further research in the future. There is not much information in the literature on key stakeholders in FRM, even though key stakeholders are major players in decision-making and implementation of FRM. Identification of key stakeholders is crucial because they are the fulcrum around which resilience in FRM strategies revolve.

This study began with the main research question - What is the response capacity of key stakeholders in FRM in the city of Accra for dealing with the unexpected course

of flood disasters in addition to the expected features of flood risk in their management strategies? For convenience and logical sequence to carry out the study, the researcher strategically split the main research question into three specific questions and the main research objective into three specific research objectives. In a sequential order, each research corresponds to the research objective that it aims to achieve.

As first specific objective, this study identified key stakeholders of FRM in the city of Accra. This objective corresponds to the specific research question 1. The empirical findings in Chapter 4 answer this research question and its objective. The Table 10 indicates the scope of key stakeholders in FRM in the city of Accra, and emphasizes on the roles of key stakeholders in relation to legitimacy, influence, and urgency among the organisations in the formulation and implementation of FRM strategies. Many studies have been conducted on stakeholder identification and analysis in natural resource management, business management and disaster risk management (Freeman, 1984; Miles *et al.,* 1995; Bryson, 2004; Frooman, 2006). Similar studies have been conducted about stakeholder analysis in FRM (Buckles and Chavelier, 2008; Reed *et al.,* 2009; Sempijja, 2013).

However, these studies focused on general stakeholders including individuals and organisations but did not distinguish key stakeholders from ordinary stakeholders of FRM. Thus, the identification of key stakeholders in FRM contributes to fill this gap. This research has pointed out this key stakeholder component as its contribution to stakeholder concept, identification and analysis of FRM. The key stakeholders in FRM are the centre around FRM strategies, and the aspects of the resilience of these strategies evolve.

The second specific objective of this thesis has been to analyse the capacity of the key stakeholders in FRM for responding to the unexpected course of flood disasters in addition to the expected features of flood risks in their management strategies. The research findings presented the Chapter 5 address this research question and its corresponding research objective. The key findings indicate that the key stakeholders apply FRM strategies with indicators that describe aspects of anticipation and aspects of resilience. The third research objective has been to

derive hypotheses about the meaning of the aspects of resilience for the advancement of the FRM strategies in the city of Accra.

The framework for the operationalisation of resilience in FRM is an initial approach to applying the concept in the field that captures elements of anticipation and resilience principles. The major conceptual contribution of the thesis can be found in third research objective. The hypotheses presented in chapter 6 are reflections on the empirical findings on the aspects of resilience and anticipation in the FRM strategies. These hypotheses challenge future studies that would test them for verification and further development of the framework. This framework is the effort aimed to understand and explain the meaning of resilience and anticipation in FRM strategies. Wildavsky (1991) explains and recommends that application of resilience in risk management is a balance of principles of anticipation and principles of resilience. Operationalisation of resilience in FRM strategies in this study is an extension of Wildavsky (1991) and similar to the works of Sutcliffe & Vogus (2001), Kendra & Wachtendorf (2003), McManus (2007) and Wardekker *et al.* (2010). The empirical findings have accomplished these three research questions and corresponding objectives.

8.2 Demand for future research

The following are recommendations for future research on resilience in FRM strategies.

Future research on resilience in FRM strategies can consider a study design with multiple case study sites. Research design for multiple case study sites would allow for a larger sample size and diverse research participants for in-depth understanding. This approach can yield findings feasible for generalisation.

It is also recommended to test the framework for operationalisation of resilience in FRM strategies in other cities and Accra. Testing of the framework can provide opportunity to confirm its general application. The framework can also be tested in flood event management.

The proposed hypotheses also need to be tested for confirmation or rejection. Testing of the hypotheses could help improve the framework for operationalisation of resilience in FRM strategies.

Implementation of these recommendations can be helpful for application of the framework for research and policy advice on resilience in FRM and disaster risk management in general.

8.3 Recommendations for formulation and implementation of FRM strategies in the city of Accra

The following recommendations are made from the empirical findings for improvement of FRM in the city of Accra.

There is a need for effective implementation of FRM measures through enforcement of land-use regulations and maintenance of drains. Empirical findings of this study revealed that spatial land-use plans and regulations in the city of Accra are flouted. Consequently, there is encroachment on waterways, flood-prone areas and on shoulders of drains. Encroachment blocks or diverts water from drains to cause floods. Plans for the enforcement of land-use and regulations could minimise encroachment on waterways to reduce flood risk.

There is a need to operationalise resilience in FRM plans in the city of Accra. The concept of resilience appears in the policy documents of disaster risk management plans of AMA and Ghana. The National Disaster Management Organisation of Ghana policies focus on disaster risk reduction and subscribes to the principles of the Hyogo Framework for Action 2005 - 2015 and the Sendai Framework for Disaster Risk Reduction 2015 - 2030. These international disaster management frameworks prioritise resilience in disaster risk management. There is a need for local level resilience framework using these international disaster resilience principles. This framework for resilience disaster management would require a commitment from the city authorities for its implementation. Resilience in disaster risk management requires a continuum of the activities of the preparedness, emergency and post-disaster management phases together.

Stronger coordination of FRM organisations is necessary and might be relevant to include the implementation of FRM strategies. There are platforms for coordination of organisations to formulate FRM policies and activities in the response phase. However, disaster management activities in preparedness include implementation of FRM measures and regulations. These activities need to be coordinated, monitored and crosschecked by the disaster management committees to ensure effective implementation of FRM measures at all phases.

Coordination with flood-prone communities and local traditional rulers in the formulation and implementation of FRM strategies would be useful for enforcement of land-use regulations and building codes for reduction of flood risk. For instances, president of the Ga traditional council of chiefs need to have a representation in the Accra Metropolitan Disaster Management Committee. This approach can be a way forward to integrate the local communities into FRM to help regulate encroachment on waterways and discourage the release of flood-prone lands to developers. Involvement of local community leaders in FRM can also reduce tensions and resistance to relocation and eviction of developments in flood-prone areas.

Provision of adequate resources in time for FRM is also crucial. Response to flood risk requires human, financial and infrastructural resources to be successful. Many government organisations of disaster risk management in the city of Accra do not have adequate resources for FRM. Disaster risk management fund comes late and it is usually inadequate. Monitoring the development of flood hazards and vulnerabilities is also challenged with inadequate staff and logistics. Infrastructure, especially drainage and temporary floodwater detention facilities are not enough. Similarly, waste management and sanitation in the city of Accra is sub-optimal due to inadequate infrastructure. Moreover, inadequate road network also leads to traffic jams and delays in rapid response to flood scenes. It is recommended that establishment or designation of emergency response lanes in the road network could be helpful for agile and timely response of the search and rescue team to unexpected course of flood disasters.

The culture of maintenance: The main engineering approach to FRM is channelisation. In the first place, these channels are not adequate to cover the entire city of Accra. However, the few channels available are poorly maintained to the

extent that most of them have been choked with silt and urban waste to their shoulders for several years. Subsequently, the purpose of their existence is defeated. A culture of maintenance is needed to ensure that drainage in the city is free of debris and silt to function appropriately.

There is a need for a flood risk conscious society. A culture of flood risk consciousness among individuals and the public can be useful for effective FRM. The citizens would have duty to report illegal developments on waterways to city authorities if they are conscious of flood risk. Subsequently, facilitation of effective implementation of FRM strategies in the local communities can be realised.

8.4 General concluding remarks

The lack of theory of resilience is a challenge also for its application in disaster risk management and in FRM strategies. However, international policy and research advocacy for the application of resilience in disaster risk management, including FRM, is a motivation for further studies in this field. The framework for resilience in FRM strategies in this study is a generic and can serve as initial approach to the topic. Resilience in FRM strategies is a continuous process and not static. The framework for resilience in FRM strategies in this study is not a prescriptive.

9 References

9.1 Literature

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10 Appendices

10.1 Appendix I Interview guide

INTERVIEW GUIDE FOR A DOCTORAL THESIS RESEARCH PROJECT ON:

FRM strategies and resilience: The capacity of key stakeholders to respond to the unexpected course of flood disasters in Accra, Ghana

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July - September, 2013

Introduction

This research is purely for academic purpose and the data being sought are primarily for the fulfilment of requirements for a doctoral degree of the researcher, Raphael Ane Atanga, from the Dresden Leibniz Graduate School, Faculty of Environmental Sciences, Technische Universität Dresden, Germany.

The general purpose of this interview is to obtain your candid opinion on flooding and FRM (FRM) in the city of Accra. In particular, the focus of this research is to solicit knowledge concerning your organisation and other organisations considered as actors of FRM in the city of Accra and the current FRM strategies. The interview includes the following main aspects – general issues about flood risks and actors of FRM as well as management strategies of your organisation for dealing with flood disasters in the city of Accra.

Please, note that your personal identity is treated unanimous in the data analysis but the identity of your department/organisation and your position might be used if you would kindly agree. Except for the sole purpose of this research, all information obtained from you is held confidential. Thank you.

Yours sincerely,

Raphael Ane Atanga.

SECTION 1: FLOOD DISASTER RISKS IN THE CITY OF ACCRA

A. General FRM issues

1. What do you think are the main causes of flooding in the city of Accra?

2. How would you describe the problem of risks from flooding in the city of Accra?

3. How probable is the city of Accra to future flood risk from the perspective of your organisation?

4. What does FRM (FRM) mean to your organisation?

SECTION 2: FRM STRATEGIES OF THE STAKEHOLDERS

A. Key stakeholders

1. Do you think your organisation is a key stakeholder of FRM in the city of Accra?

2. Are you the representative of your organisation for FRM in the city? If yes, what are your tasks in this position?

3. What organisations do you think are also key stakeholders of FRM in the city of Accra?

B. The 'stake' in FRM

1. What is the official role (including responsibilities & tasks) of your organisation for FRM in the city of Accra?

2. What do you think are the specific interests of your organisation in FRM in the city of Accra?

C. Barriers and Enablers of FRM

1. What are the barriers and enablers that your organisation experiences in FRM in the city of Accra?

SECTION 3: ANALYSIS OF ASPECTS OF RESILIENCE OF THE FRM STRATEGIES

A. Awareness of the organisation regarding FRM

1. How is your organisation aware of its roles in FRM in the city of Accra?

2. Is your organisation aware of the possibility for unexpected course of flood risks with their impacts in the city of Accra?

3. How does your organisation keep track on the unexpected course of flood risks in the city of Accra?

B. Response capacity of the organisation

1. What resources (human; financial, technical and logistical resources; time etc.) do you think your organisation has for managing flood risks in the city of Accra?

2. How does your organisation mobilise additional resources for dealing with flood risks?

3. What lessons have your organisation and other organisations learned from its performance in responding to previous flood events in the city of Accra?

C. Collaboration of the organisation with other organisations

1. How is FRM in the city of Accra coordinated between your organisation and other organisations?

2. How do your organisation and other organisations share and communicate information regarding FRM in the city of Accra?

3. Is there a common goal for FRM among all stakeholders in the city of Accra? If yes, what is the relationship between this goal and the goals of your organisation for FRM?

4. What strategies do your organisation and other organisations use to ensure timely redistributing of tasks and response to unexpected cause of flood disasters in the city of Accra?

5. How does your organisation together with other organisations of FRM activate additional (redundant) resources for responding to the unexpected course of flood risks?

6. How do your organisation and other organisations of FRM ensure a common exploitation of previous FRM experience?

D. Public involvement in FRM activities of the organisation

1. Through what ways does your organisation ensure that public is involved in FRM in the city of Accra?

Do you have additional issues of FRM in Accra that you want to highlight for purposes of this research?

10.2 Appendix II Selected interview codes and quotations

This appendix is not published due to ethical reasons.